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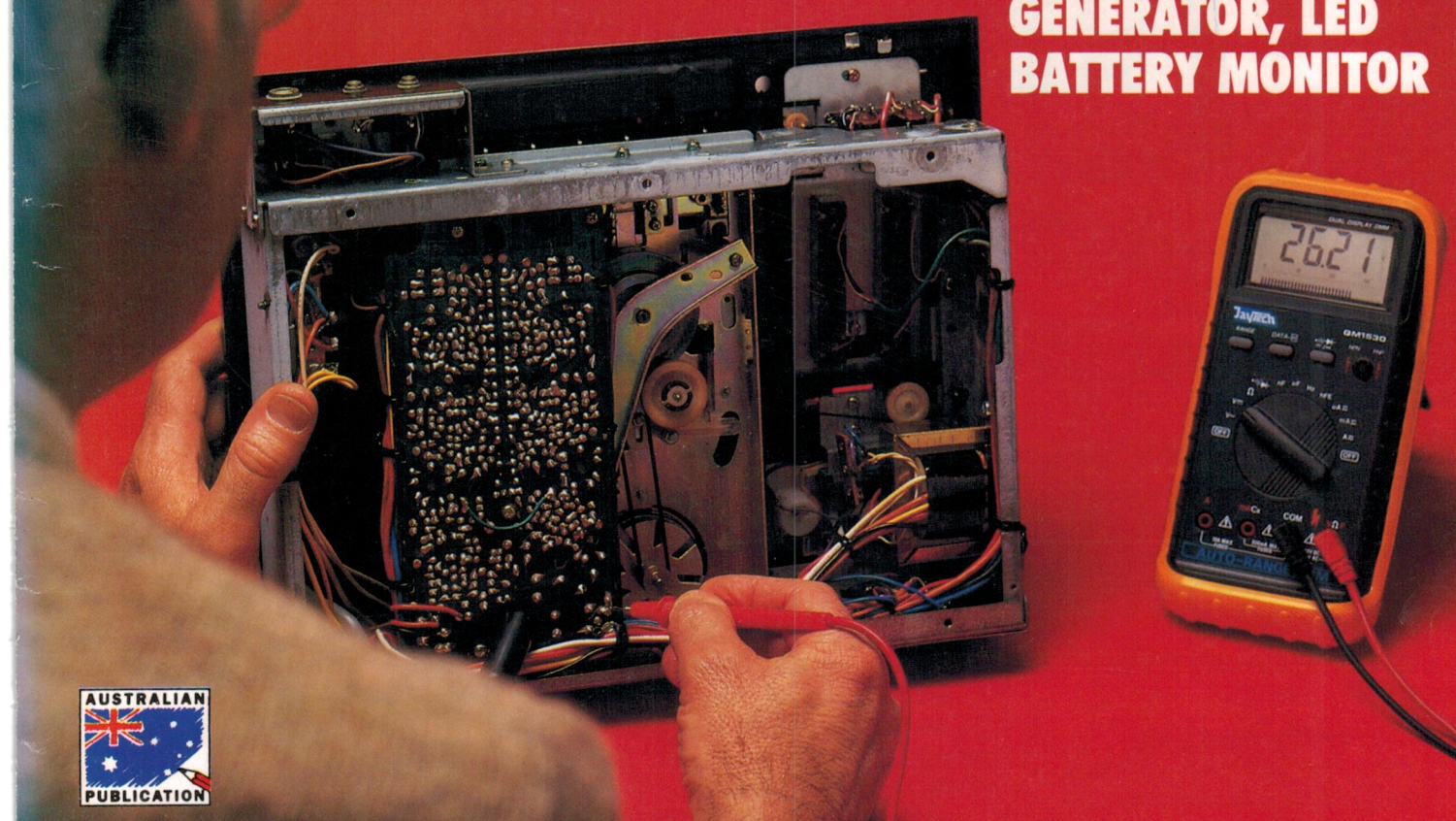

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DIY FAULTFINDING: TIPS FROM AN EXPERIENCED TECHNICIAN

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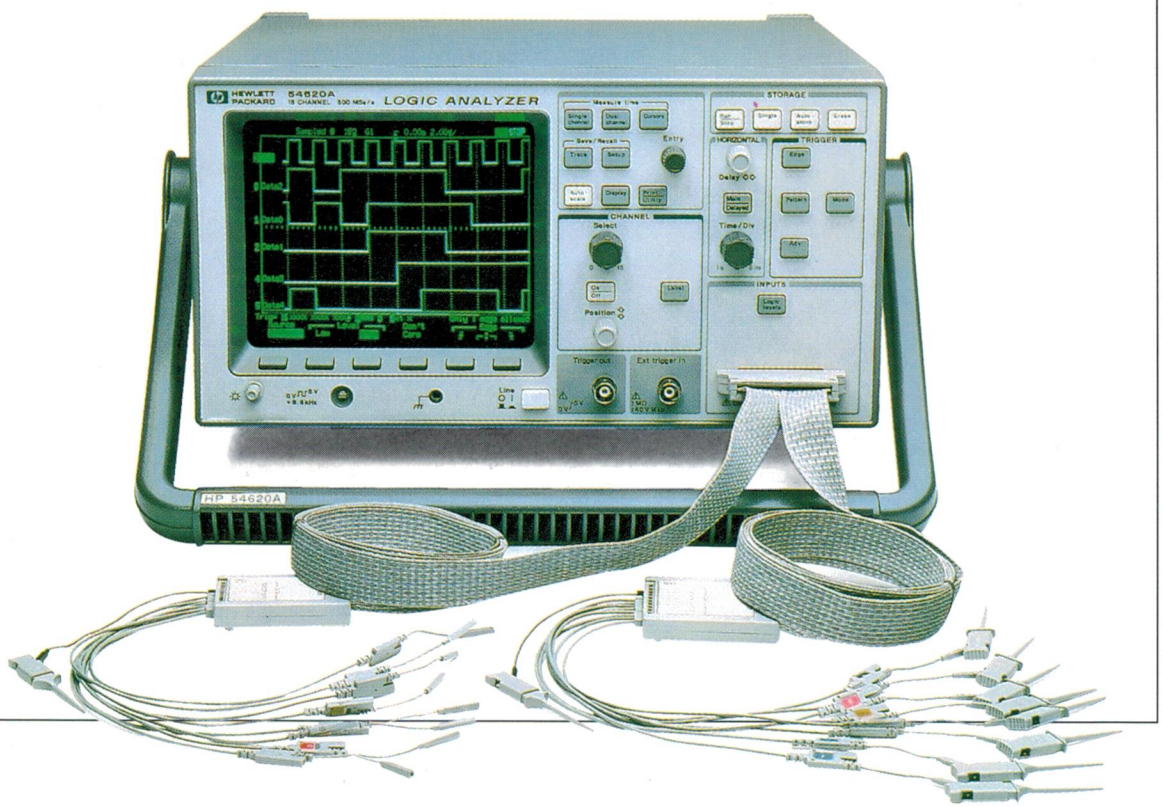
Could this really be a logic analyser?



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Electronics AUSTRALIA WITH ETI

Volume 57, No.9
September 1995

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Faxing with a PC

There's now an impressive range of hardware and software to make it easy to send and receive faxes via your PC. Tom Moffat provides a guide to what's available and how it's used, in his feature article starting on page 14.

Four channel auto scope

Latest addition to the handheld auto diagnostic instrument market is the OTC 'Vision' unit, which combines a dedicated four-channel automotive DSO with a four-channel DMM. Nick de Vries reviews the Vision splendid in his column, starting on page 14.

On the cover

Even if you're 'in electronics', fixing your own equipment can be quite a hassle. Happily this month we present a helpful article from an experienced technician, to guide you through the pitfalls (see page 46). Our editor is shown here playing the role of an intrepid DIY serviceman. (Main photo by Peter Beattie.)

Video and Audio

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Projects and Technical

Professional Electronics

Columns and Comments

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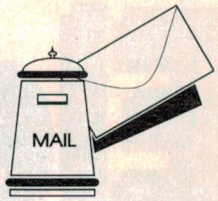
LETTERS TO THE EDITOR



Surround decoder

Recently I was looking at the circuit of the decoder section of the Stereo TV Sound Receiver on page 59 of the January 1995 issue. I thought the values of R35 and C41 were a bit low. This is the first order low-pass filter for the L-R output. So, out with the calculator, and I came up with a frequency of just over 70kHz which is 10 times what it should be. As R35 also sets the output impedance of U3c, I suggest that C41 should be changed to 33nF to achieve the desired 7kHz cut-off frequency.

As the Surround Sound Decoder described in the May 1995 issue is based on the above circuit, the same problem exists. With reference to the circuit on page 69, R10 and C6 form the low-pass filter for the L-R output. In this circuit the filter is followed by a buffer, U2d, and R18 sets the output impedance. In theory R10 should not be less than 10k, but this would require C6 to be changed as well. Therefore, I suggest that R10 be changed to 6.8k and C8 left as is to achieve the 7kHz cut-off frequency.

A few days ago I built the Power Transistor Tester for May 1988 from a kit I bought three to four years ago. The tester worked OK, but I found the measured transistor gain varied from that on the scale somewhat. With reference to the circuit on page 71, assuming the input is 12 volts and the base current is adjusted to null the LEDs, then there is six volts across the 12 ohm collector resistor which gives a collector current of 500 milliamps.

Unfortunately the article and gain scale artwork are based on a collector current of 600 milliamps. So I put two by 120 ohm 1W resistors in parallel with the 12 ohm 10W resistor to give an equivalent resistance of 10 ohms. This now gives a collector current of 600 milliamps when the LEDs are nulled and the measured transistor gain is close to the value on the scale.

I trust the above may be useful. I have been an *EA* reader for about 35 years and look forward to receiving my copy each month. Keep up the good work.

Paul Fletcher,
Mt Gambier, SA.

Comment: Thanks for your feedback, Mr Fletcher. You're quite correct in your suggestions regarding The Stereo TV Sound Receiver and the Surround Sound Decoder. Our face is suitably red, and we're publishing a correction in Notes and Errata. Your suggestion regarding the Power Transistor Tester also sounds a good idea.

VET designer

Thank you for the very nice plug for VET in the June issue. Things are going very well; we have certainly come a long way since I gave the first copy of VET to my students at Chisholm six years ago!

I have probably told you before, but your readers may be interested to know that before I became a computer virologist, I was an electronics engineer. I graduated in Electrical Engineering from Melbourne in 1964 — we had one lecture in final year on the new fangled semiconductors! — and I set up CYBEC Electronics in 1978, a few months before Whitlam took the tariff off imported electronics and the local industry collapsed.

VET, incidentally, is my third claim to fame. I first received international recognition for a paper published in 1967 describing the first practical high performance gyrator. At that time, trunk line telephony relied on complex and expensive linear filters, and my circuit played an important part in the realisation of relatively inexpensive high performance active filters. However, digital techniques have taken over, and now there is little interest in linear filters.

Then in 1989 I designed the electronics for the Loop-a-Line, manufactured by Teletech Pty Ltd, and adopted as a standard test instrument by the Australian and New Zealand Telecoms. This permitted a technician to attach a tone generator to one end of a line, go to the other end and identify the line, and then send a signal to either disconnect the tone generator so that (s)he could attach and test a telephone, or put a short across the far end of the line so that a bridge could be used for fault location.

Last, but perhaps not least, about 30 years ago *Electronics Australia* published a circuit of mine for an automatic stop mechanism for a Labgear pickup, using

a phototransistor switch, in the Reader Built It section.

Roger Riordan,
Managing Director, Cybec,
Hampton, Vic.

Radar transponder

I am not now a regular reader of your excellent magazine, due to other current commitments, but I believe your general policy is to present projects which have relevance to your readers and the general public.

I would like to suggest a project which would have a great deal of relevance to the small craft population, i.e., yachtsmen, fishermen — both commercial and recreational — which would be simple and cheap to construct, and which could save numerous collisions and assist in search and rescue operations. The piece of equipment I am suggesting is a radar detector/transponder operating on 12V DC and capable of detecting and responding in the marine 3cm and 10cm radar bands. Those two frequencies cover all radars used by commercial and pleasure vessels.

In use, the transponder, which would be switched on at sea in the small vessel, would detect a radar beam sweeping over the unit and re-transmit to the big ship, causing a distinct blip to appear on her radar display and alerting the officer on the bridge to determine bearing and distance to the target vessel. At the same time the transponder would activate an audible and visible alarm on the small vessel, alerting the occupants to the proximity of a larger vessel. In search and rescue operations, of course, the searchers with a radar set can determine direction and distance to the target.

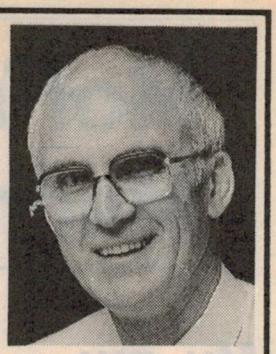
There are in the market large transponder units which are used in harbour approach bouyage and large commercial vessels, but such units are too bulky and expensive for small boat people.

I would be very happy to cooperate with any technical people you have who may be interested in developing a small inexpensive miniature unit as I have outlined.

Captain Rob Rae,
Weipa, Far North Qld.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Unwise statements regarding exposure to RF radiation

A week or so ago, ABC-TV's *Four Corners* program explored the subject of health risks associated with RF electromagnetic fields, from handheld cellular phones and other transmitters. I don't know whether you saw this program, but it certainly gave *me* cause for concern — for two reasons.

One of the cases examined concerned a police officer who had apparently been part of a covert surveillance team, the members of which spent much of their time inside a van. The van was apparently fitted with a two-way radio transceiver with 25W output, but with its antenna *inside* the van (presumably with the idea of hiding the van's real function). This was bad enough, considering that all of the van's occupants would have been subjected to frequent doses of quite high level RF (inside a largely metal enclosure!). But what really flabbergasted me was that apparently the only place for the chap concerned to sit, inside the van, was on TOP of the antenna — which was pointing upwards!

The unfortunate officer concerned has subsequently been very ill, and lost a testicle to cancer. What amazed me, though, was that the authorities still didn't seem to accept that his health problems could be linked to his intimate exposure to RF in the van! It appears that the onus is on him, to gather evidence supporting such a link. That's surely a matter of great concern, for anyone whose job involves them working with significant exposure to RF energy...

The other two cases involved people who had developed brain tumours. One was a woman in California, who demonstrated handheld cellular phones for many hours each day; the other a technician who serviced mobile transceivers. Like the first case, both of these were very moving; but here what I found really disturbing was the apparent unwillingness of *some* of the 'experts' interviewed, to consider that the RF exposure of the people concerned could conceivably be linked to their illnesses, in a causal way. In a number of cases they seemed to be taking the position that because the E-M field strengths produced by the equipment concerned were lower than 'accepted standards for safety', there couldn't be a causal link.

One of the most basic tenets of science is that we can never totally 'prove' anything about real-world phenomena; we can only formulate an explanatory theory, and assemble evidence which either supports the theory or its contradiction. And regardless of how much evidence we may have either way, there's always the chance that further evidence can turn up to reverse the situation. This sort of thing has in fact happened quite often, particularly with regard to phenomena and/or activities which effect human health in a cumulative and long-term fashion. Examples are X-ray and ultraviolet radiation, asbestos and smoking.

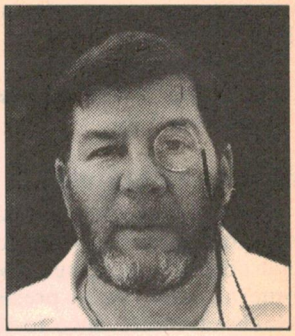
Surely this makes it extremely unwise for *anyone*, particularly an expert, to make statements of the type we saw in that *Four Corners* program. It's quite conceivable that further investigation could show that current 'safe levels' of exposure to E-M radiation are in reality far too high — and that the illnesses of the people we saw on the program *can* be attributed to their exposure.

Frankly, I wouldn't be at all surprised.

Jim Rowe

Moffat's Madhouse...

by TOM MOFFAT



My, my — it's really Sci-Fi!

Let us set the scene. A man and his girlfriend are out on a lonely stretch of road in the New Mexico desert. It is a stormy night and they huddle together for warmth and comfort (and other things). Suddenly there is a streak across the lightning-lashed sky, a glowing orange ball with a luminous trail. The ball slams into the ground, less than a mile away.

When the rain ends the man wants to go have a look, to see what happened. The girl is less than enthusiastic, but she finally agrees; so they hop into their four-wheel drive and strike out cross country. Soon they rise over a hill, and down the other side, nose into the ground, is a crashed aircraft of some kind.

It doesn't look like a normal aircraft; there are no wings and it's kind of crescent-shaped. They would like to have a closer look, but the batteries in their torch are going flat, and they certainly wouldn't like to go down there in the dark. So they decide to go back to their campsite and return next morning in daylight.

Soon after sunrise, they board the jeep again to go look at the crash site. This time it is much clearer; they see that the downed craft has nosed into the side of a small cliff. There is some debris scattered around and, and... are those bodies? They pick up some pieces of the debris — strange, lightweight metal — but the girl decides right then and there that she wants to 'get the hell out of there'.

They toss some of the wreckage into the jeep, but just as they are leaving, there's a roar in the distance. They see a big line of army trucks and staff cars, and one of them has a siren going. The soldiers jump out and surround the crash site. The girl is still anxious to get away, so they high-tail it before the army discovers them there.

Sound familiar? Maybe so, if you've seen a film called *It Came From Outer Space*. This great old science fiction classic from the 1950's surfaces on SBS television from time to time, and it's well worth a watch. It was made in the days when science fiction was designed to give you the screaming heebie-jeebies, instead of just spreading blood and guts all over the place.

In *It Came From Outer Space*, I don't think you ever got to see the occupants of the crashed spacecraft. Instead you saw the humans, from the aliens' point of view, through the effect of a great big watery eye. You'd see people poking around the crash site, totally unaware they were being watched. And you just knew they were going to be pounced on and meet some unspeakable fate any moment.

Actually the scene described above was not from *It Came From Outer Space*. Instead it is from a recent book, entitled *The Truth About the UFO Crash at Roswell*. This book purports to be fact, not fiction, and it produces some pretty convincing documentary evidence. It's particularly interesting to me because it strikes close to home, literally.

Roswell is in the New Mexico desert, perhaps 200km from Albuquerque, where I grew up. The 'UFO crash' occurred in 1947 when I was just a little nipper, but I was there regardless. My father had recently been discharged from the army, but we continued to live on a military base since he went to work for a government research lab sited there for security reasons.

The *UFO Crash* book names a lot of names of witnesses to the crash, and especially the top military people from Roswell who were involved in the investigation and alleged cover-up of the crash (it was explained away as a weather balloon). And when I saw some of the names I was rather surprised, to say the least.

I am almost certain that some of those people named as involved in the Roswell affair later turned up in Albuquerque, posted to the base where we lived. Transfers within the military are common, and a transfer from Roswell to Albuquerque would be a much-desired promotion. As I remember one of the Roswell top brass even became Commanding Officer at Albuquerque. I think I went to school with his daughter...

It does make you wonder about a book like this, especially if they name names and you know the names, personally. The book claims the bodies of the occupants of the UFO were recovered and taken to the hospital at Roswell, and later to Wright-Patterson Air Force Base in Ohio, where complete autopsies were performed. It further claims that one of the occupants was in fact alive, and able to walk from the ambulance into Roswell hospital unaided. He (it) later died of his injuries. Did our own military neighbour witness this?

Let's just go back to the film for a moment. It is interesting that it so closely follows the scenario of the Roswell crash. The crash happened in 1947; *It Came From Outer Space* was made in about 1952, five years later. Yet 'true' accounts about the UFO crash didn't begin to surface until perhaps 30 years after the event.

So where did the inspiration for the film come from? Was one of its producers privy to 'classified' information? Or alternatively, were later accounts of the Roswell UFO crash inspired by films like *It Came From Outer Space*? Regardless of what is the true story, both the film and the book make excellent science fiction/fact/whatever.

The UFO 'flaps' of the late 1940's provided some excellent fodder for science fiction film producers. It's interesting that many of the UFO incidents depicted involved 'monsters' who were on earth either for peaceful purposes, to help 'backward Earthlings', or they got here by accident.

You might remember *The Day the Earth Stood Still*, described in this column about four years ago. It was

probably the first anti-war film, made when the world was in the grip of nuclear madness. The main thrust of that film was that if the Earth didn't belt up and stop fighting, alien forces would stop the fighting for us, permanently. So it was malevolent — but for a good purpose.

As for *It Came From Outer Space*, its aliens were here simply because of a mechanical malfunction in their ship. They didn't really want to scare anyone, but they did a pretty good job of it anyhow. Theory has it that the Roswell crash came about for the same reason — mechanical failure — another interesting similarity.

Television came along, in the USA at least, at about the same time — the late 1940's. And amidst the steady diet of ice-hockey games and wrestling matches, TV producers also jumped on the sci-fi bandwagon. Who of my vintage will ever forget *Space Patrol*, pronounced 'Spaaace Patrolll' in a loud voice. These were the words that started each episode as the two characters (only the two) began their performance.

What did they do? Well, they patrolled space. I can't remember the boss-man's name, but his sidekick's name was Happy. These two guys in their silver flight suits would bumble about in a field of 'icebergs' on an alien planet (actually white-painted cardboard boxes in the TV studio) yelling "Look out!" One of the cardboard boxes would then quiver and shake, and the two actors would apply horrified looks to their faces.

Then the voice-over announcer would break in with "Be sure to tune in tomorrow for the next thrilling episode of (turn on echo chamber) Spaaace Patrolll". Rough as guts, this stuff, but as an impressionable little boy, I loved it. Someone else must have loved it too, because a couple of years ago the whole series got a re-run on SBS, late at night so as to avoid the gaze of the television reviewers...

A later enhancement on *Space Patrol* was *Lost In Space*. Here we had what appeared to be much the same studio set, although with more actors — this time a whole family named Robinson (as in Swiss Family...). As I remember there was a man and his wife and their son and daughter, as well as an intelligent robot named Robbie.

The family would bumble about amongst the cardboard icebergs yelling "Look out!", but when really serious trouble came along, Robbie the Robot was dispatched to deal with it as the family cowered in their spaceship. This was surely a case of anti-robot discrimination. I have heard that *Lost In Space* may soon be re-run in Australia, but I haven't been able to pin it down.

The absolute epitome of the sci-fi shows was *Outer Limits*. This was the real hard-core stuff. Every episode was different; most involved aliens, but here on Earth, not in space. In other words, invasion. In other words, terror!

There were some pretty clever plots. One involved a space-ship ride at a theme park (Disneyland?). Patrons would file onto the ship and strap themselves in; it would then quake and quiver and take off. A most impressive ride, especially since it was real. The patrons were actually being kidnapped by aliens...

Or another story: a late-night announcer doing a solo shift in a small country radio station in the middle of the desert. His transmitter's signal is intercepted by aliens, who use it as a vehicle to beam themselves down to earth, right into the announcer's control room. I watched this one late one night — would you believe — just after I got home from my solo shift in radio station KPTL, a small station in the middle of the desert near Carson City, Nevada. Talk about a bad case of the willy-willies!

As far as I'm concerned, *Outer Limits* was the last of the scary stuff. Later programs like *Twilight Zone* didn't hold a candle to *Outer Limits*. Every *Outer Limits* episode was shot in black and white, so they're not likely to get a run nowadays — although one of the cable television networks in the USA has dragged them out for another airing.

Should they ever turn up in Australia (c'mon SBS, how about it?), do not miss *Outer Limits*. "WE have control of your television set. WE control the vertical. WE control the horizontal. Stay with us now as we take you to (shudder!) The Outer Limits." Eeek!

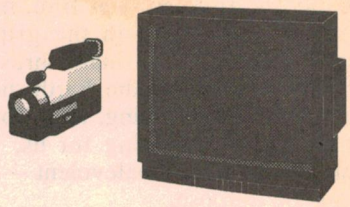
Modern television sci-fi? Well, we did have *Star Trek*, for a very long time. It was ground-breaking stuff too. Remember, for instance, the *Star Trek* personal communicators? We know them now as the Motorola cellular flip-phone.

Star Trek stories weren't anything up to the standard of *Outer Limits*. But where *Outer Limits* relied mostly on the terror of the unseen from outer space, *Star Trek* showed everything with great special effects.

Now we've got a thing called *The Next Generation*. The rootin'-tootin' crew of the Starship Enterprise, Captain Kirk, Scotty, Bones, Uhura, all of them, have gone to the Trekkie retirement village. Now a bunch of portly crew-persons in lycra jump-suits prance about and utter politically correct platitudes (say nice things about your alien attackers, so as to avoid charges of discrimination).

Well, I watched this abomination a couple of times because it did carry the *Star Trek* label. But I've given up now. And I think the TV station has given up too. The thing has been consigned to the after-11pm time slot. Phooey — give me *Outer Limits* any time! ❖

What's New in VIDEO and AUDIO



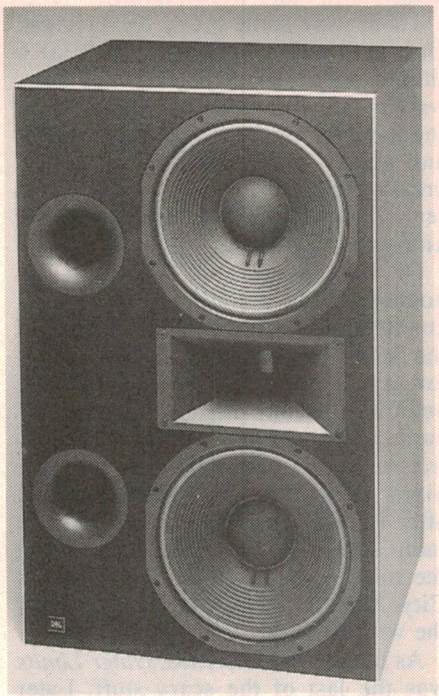
Digital monitor system from JBL

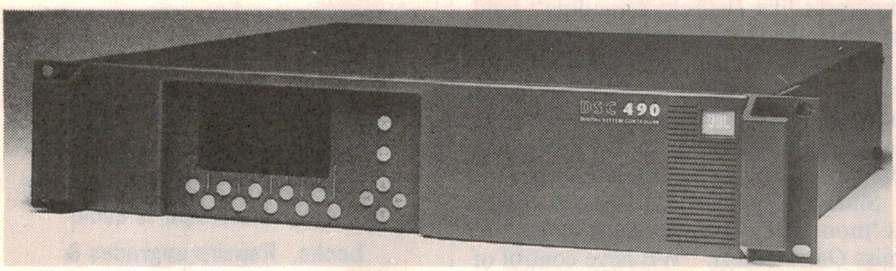
The new JBL DMS-1 digital monitoring system features what is claimed as the world's first professional neodymium low frequency transducer, a neodymium high frequency transducer with a unique diaphragm material, and a very low distortion constant directivity horn.

The DSC490 digital controller provided with each DMS-1 system is pre-programmed to optimise overall system performance.

The controller combines the functions of a stereo two way crossover, signal alignment delay and multi-band equaliser in one digital processor. The result is a monitor system which is capable of extremely high SPL (sound pressure level) over a wide bandwidth, with low distortion.

Very flat amplitude and linear phase response provide the highest degree of accuracy.





Car power amps from Kenwood

Greater power, balanced inputs, cooling fans, copper plated transformers and power FET technology are but a few of the latest features in Kenwood's new stable of car power amp 'thoroughbreds'.

Designated the KAC-PS200 (100 watts/channel), the KAC-PS150 (75 watts/channel), and KAC-PS100 (50 watts/channel), all boast Kenwood's Tri-Mode operation that allows the amplifiers to be configured in three modes of operation. Firstly, in 'standard' two-channel stereo mode; secondly, in mono 'bridged' mode, and thirdly, via a passive network such as Kenwood's KPX-T120, for stereo operation plus a subwoofer channel.

The KAC-PS series amplifiers are designed to partner any of Kenwood's cassette/receivers, CD/receivers, tuners or 'control' tuners, are designed for boot installation and can be mounted either horizontally or vertically.

Cooling fans are employed in the KAC-PS200 and KAC-PS150 to maintain nominal operating temperatures and prolong component life. Kenwood have also incorporated a variable low pass filter in both the KAC-PS200 and KAC-PS150 amplifiers and a fixed 80Hz low pass filter in the KAC-

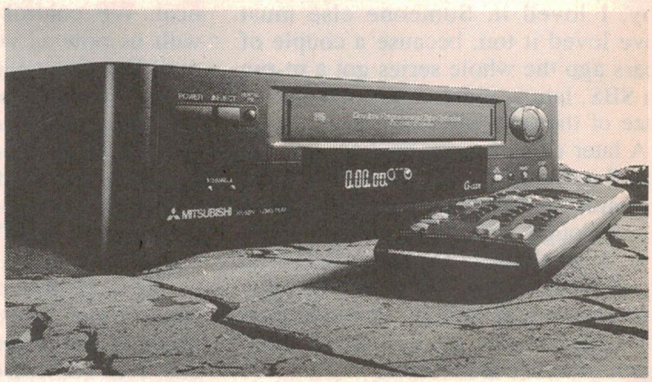
Dual speed VCR has tape optimiser

A new value packed video cassette recorder (VCR) from Mitsubishi Electric offers conveniences and features normally found only on more expensive models. For example, the Long Play mode on the model HS-521V allows you to double the play or recording time of your video tape, making it ideal for sporting events.

The Tape Optimiser circuitry automatically assesses the quality of your video tape to provide the best possible picture. If tapes are new or high grade, the Tape Optimiser enhances picture sharpness; if they are old or worn, it softens the image slightly.

By using the Tape Optimiser in conjunction with the Rental Tape function, the VCR improves picture quality, automatically fast forwards to the beginning of the programme for viewing, rewinds and rejects the tape after it has been shown, and then turns the VCR off.

The 'technically challenged' will appreciate the



simplicity of this unit too, with features like simple One-Key or G-Code programming and colour coordinated displays and keys.

Mitsubishi VCRs are available at selected electrical goods retailers nationally. The HS-521V has an RRP of $529.

New midi systems from Sony

Sony Australia has strengthened its commitment to Midi systems with the release of three new price competitive, five disc changer models.

All new models feature one-touch play, which means you only have to press one button to turn the system on, select the function you want to use and begin playing.

The three new models start from around $799 and comprise a five disc changer CD player, double cassette deck, amplifier, tuner and speakers.

The Sony LBT-N250 delivers 35 watts per channel and has surround speaker outputs for those wanting to integrate audio and video for more realistic home theatre viewing. The unit has a 1-bit pulse D/A converter, five-disc CD carousel changer including shuffle, repeat and program play. It also has an FM/AM tuner with a 30 preset station memory and a twin cassette player with high speed dubbing.

The LBT-N250 has two-way speakers with 17cm bass drivers for powerful bass sounds. When used in conunction with the Dynamic Bass Feedback function which reinforces low frequencies, the new Sony Midi system produces deep and rich bass output. The LBT-N250 comes with a remote control and has a recommended retail price of $799.

The LBT-N350 has almost twice the power output of the

N250, offering 60W RMS per channel which results in greater quantities of high quality sound. It also has three-way speakers with 22cm bass driver, as well as tweeter and super tweeter. The LBT-N350 comes with a full remote control and has a recommended retail price of $999.

The LBT-N550 is a separate component system which offers increased versatility when stacking the various units in your living area. Additional features offered by this system include three-way, time aligned speakers and a nine band spectrum analyser giving a visual representation of the music being played.

The Sony LBT-N550 comes with a full remote control and has a recommended retail price of $1499.

PS100 amplifier, for use in a subwoofer configured system.

Kenwood has broken new ground in providing balanced inputs to the amplifiers, giving greater immunity to noise over conventional single ended, unbalanced designs. The use of MOSFET devices in the power amplifier sections offers greater speed at higher power levels resulting in improved rise time, frequency response and thermal stability.

Other features include gold plated inputs, large gold plated outputs, increased power supply capacity, and large toroidal transformers.

All three models are covered by a 12 months parts and labour warranty and are available at selected Kenwood car audio dealers.

New large screen CTVs from Mitsubishi

Mitsubishi Electric has launched three different models of its new DIVA colour television series, which incorporates Mitsubishi's new Symphony Sound System.

Mitsubishi product manager Peter Noonan says: "The combination of a superb picture on a big screen with our new Symphony Sound System makes people watching movies or music at home feel like they are in a cinema. The Symphony Sound System includes a Super Woofer to really pump out a powerful bass. You can even connect additional speakers to achieve surround sound."

Viewers also benefit from the new DIVA's AI (artificial intelligence) Fuzzy Logic circuitry, which senses ambient light and adjusts the brightness of the picture being broadcast accordingly. (It also takes into account the viewer's distance from the TV before making the adjustment.)

Mitsubishi has taken into account convenience, too. With its Auto Turn feature, viewers get the best seat in the house. At the touch of a button on the remote control unit, the screen can be turned 15° to the left or right.

Other standard features on the new

DIVA include a multi-language on-screen menu system, on/off timer, digital clock, child lock, world wide 21 system and front and back connections for VCR, hifi, laser disc and video camera.

The new DIVA models are the CT-33AC2, with a 78cm screen (RRP $4499), the CT-29AC2 with a 68cm screen (RRP $2499), and the CT-29AC2TV with a 68cm screen plus picture-in-picture and Teletext (RRP $2799).

New speaker line up from Kenwood

Kenwood Electronics has released a new speaker line up that is 'targeting the high speaker market head on'. The line up consists of three models: the LS-P9400 (RRP $1799), a four way, six peaker, ducted system capable of 500W peak; the LS-P7400 (RRP $1299), a four way, five speaker system capable of handling 350W peak; and the LS-707M (RRP $1599) a three way, four speaker system capable of handling 300W.

Finished in 'black ash' timber veneer, all models are of the highest standard. Designed for floor mounting, all three have their high and mid frequency drive units positioned at ear level when comfortably seated.

The LS-P400 is the flagship model and weighs in at 28.5kg (62.8lbs). Employing an 'Aerohorn' ducted bass reflex system, bass extension is mooth down to 20Hz, where two 30cm bass drivers work in harness. ❖

HARMAN/KARDON TD420 'PRO' CASSETTE DECK

Despite the attractions of digital media for high quality audio recording, the analog compact cassette is far from dead. This month Louis Challis turned his critical attention to the latest stereo cassette deck from Harman/Kardon, the TD420 — described as achieving 'CD Transcription Quality'. As his tests show, this description is by no means inappropriate...

Three years ago, Philips released its exciting new DCC (Digital Compact Cassette) system. Soon after, Sony released its equally exciting new Mini Disc format. I, like most of the other international technical reviewers, believed that the release of those products heralded the imminent demise of the ubiquitous 'compact cassette recorder'.

OK, so I was wrong! But then so was everybody else (including Philips and Sony). What went wrong you ask? Well frankly, what everybody had apparently failed to take into account was 'the quietly complaining masses' — or put more simply:

1. The public presumably had decided that it was no longer willing to accept a new format and discard the old (with all its warts and pimples). Compact cassettes were tried and proven, and frankly they satisfied the primary needs of most users.
2. The public also realised that the current generation of low cost compact cassette recorders are reasonably good, the medium performance compact cassette recorders are particularly good, whilst the premium quality compact cassette recorders are positively outstanding.
3. The Sony Walkman (and its 'look alikes') have become so popular with joggers, that most prefer to record their own tapes.

As you may well have noticed, the nett result is that most people have few qualms about buying a new mains operated compact cassette recorder. Whilst their reasons for purchase may differ, with few exceptions, the primary reason for purchase is to pre-record compact cassettes for their own use in cars, in their Walkmans, or in their portable 'ghetto blasters'.

In order to satisfy that market, the Japanese, Korean, American and European manufacturers are producing an absolute plethora of low cost, high quality cassette recorders. To their credit, most of those cassette recorders are now on a par with the premium performance cassette recorders produced as little as 3-5 years ago.

Transcription quality

The Harmon/Kardon Model TD420 compact cassette recorder is described by the manufacturer as being a 'CD Transcription Quality Cassette Deck'. As it happens, that is a rather appropriate description, as my subsequent testing has confirmed.

The TD420 is only a two-head machine, but although its price is modest, it packs in a number of advanced and attractive features, including:

Music Search, which allows you to rapidly skip forward or reverse to locate the start of any desired segment on the pre-recorded tape.

Dolby HX Pro (originally developed by Bang & Olufsen and now marketed by Dolby Laboratories), which automatically adjusts the bias level in the presence of high frequency peaks to provide a linearised output response.

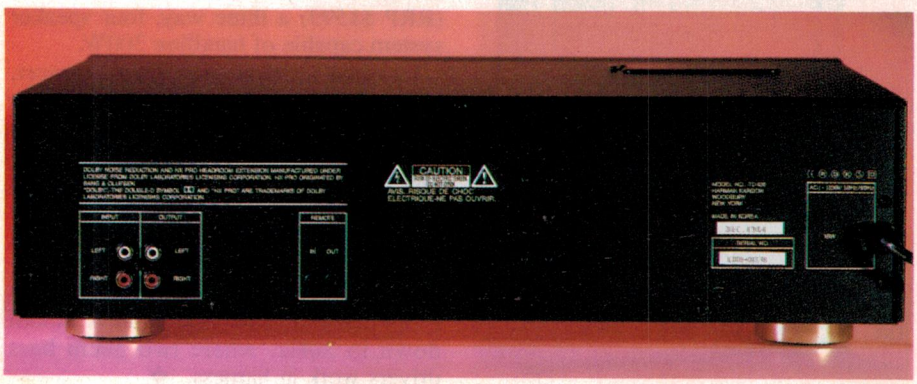
Fluorescent Display, which shows functional settings in clear alphanumerics and with a sufficiently bright display to ensure that you know what you are recording and whether the level is correct.

Head Cleaning Access, which is provided by means of a removable plastic cover on the top of the cabinet. When the cover has been removed and the cassette tray opened, clear unobstructed access to the recording heads is achieved. The heads can then be simply cleaned with a cotton bud and a proprietary head cleaner.

The frontal appearance of the TD420 is attractive, particularly when the power is applied and its display illuminated. All of the major controls have been placed on the lower contoured edge of the matt black aluminium extrusion front panel. Each of the pushbutton controls has its function identified on its face, or with white lettering immediately above.

The illuminated power ON/OFF switch is at the left-hand end of the panel. The five standard small pushbutton deck controls, together with four additional pushbuttons labelled RECORD/MUTE, INTRO SCAN, FORWARD and REVERSE SEARCH (to the start of either the next or the last pre-recorded track), all centrally placed in a linear array along the lower edge of the deck.

The controls for DOLBY ON/OFF, and DOLBY B or C noise reduction (each of which is supplemented by clear indications on the fluorescent display), and the counter reset or multiplex filter button, are elongated vertical toggle switches. Rotary controls are provided for the BIAS FINE TRIM, channel BALANCE and for RECORD level control. The cassette OPEN/CLOSE CONTROL switch is a large elongated horizontal



button at the extreme right-hand end of the panel.

When the deck is connected to a Harmon/Kardon CD player, the two items of equipment can be synchronised. Once connected, the cassette deck's controls will control the PLAY/PAUSE and STOP functions of the H/K CD player, to achieve an automated and simplified recording procedure. A very small CD SYNC button is provided on the front panel which activates this function, when required.

The rear of the deck has two pairs of coaxial colour coded sockets for INPUT and OUTPUT, and two pairs of miniatu tip and sleeve sockets for interconnecting the remote control functions with those of a Harmon/Kardon CD player.

Objective testing

I began my evaluation of the TD420 deck by assessing its replay frequency response with our standard replay test tapes. The level recordings revealed that the REPLAY performance of this deck is excellent up to 15kHz with the Maxell type '1' test tape; is reasonable, but not outstanding with the BASF type '2' test tape; and is again reasonably good (but not outstanding) with the Sony type IV replay test tape.

Each of those test tapes displayed an uncompromising replay linearity over the critical 50Hz to 8kHz region. The REPLAY responses were as close to being 'ruler flat' as one could hope for. Even the low frequency replay responses were impressive, being within +/-2dB from 15Hz to 50Hz. If the ability to record and replay a rollicking bass is important to you, then this cassette deck can most certainly deliver it.

The TD420 incorporates automatic selection of equalisation, by means of the auto-selection slots which all modern compact cassettes now incorporate. The tape deck illuminates its integral display so that the selected format (I, II or IV) is identified.

You might imagine from this that there is no justification to 'play' with the bias fine trim control, to optimise the deck's performance. Whilst that sounds nice in theory, I discovered in practice that it was not strictly correct.

As I proceeded to generate record/play level recordings at the 0, -10 and -20VU levels (with the bias fine trim control at its central indent position), I observed a consistent rise in the frequency response level between 5kHz and 18kHz. The typical rise in the response was of the order of 3-4dB, over the frequency range 2kHz to 20kHz. With Type I tapes, as typified by Sony HF60 or the TDK AD90, there was a marked peak in the response between 15-20kHz.

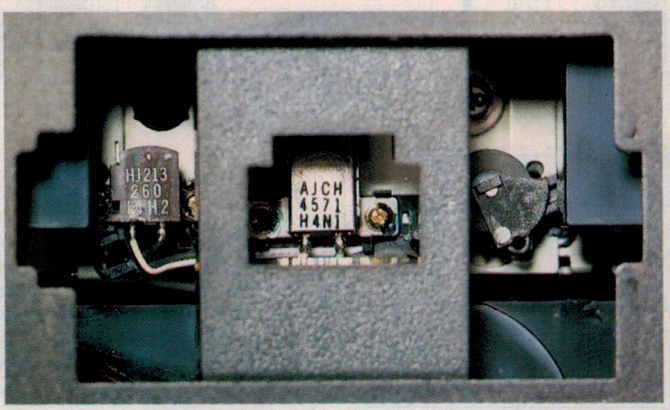
Now a rise in the high frequency response could well prove to be advantageous in some situations. It would most probably partially compensate at some later stage for slightly dirty heads. There may well be a valid reason for incorporation of this gentle rise in the record/play response. I was however intrigued, because I felt sure that the deck's overall frequency recording performance could be significantly better than what I had observed. To confirm my theory, I ran three tests with the fine bias control at +20°, on its central indent and at - 20°.

As you will see from the graphs, with the fine bias control rotated to approximately 20° to the left, the frequency response at -20VU can be modified so that it is virtually ruler flat between 50Hz and 20kHz. Conversely, if the control is rotated +20° to the right, it is boosted by approximately +5dB at 18kHz.

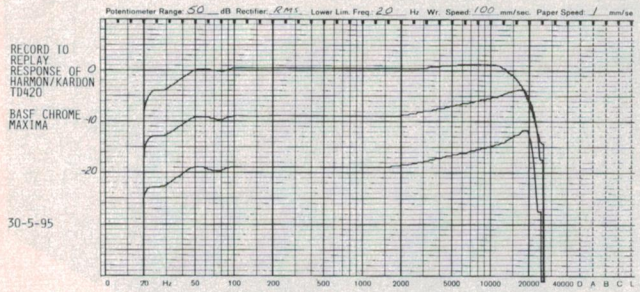
I repeated this exercise with other tape formats (Type II and IV), and achieved comparable results. Obviously, if one is interested in producing ruler-flat responses you could easily adjust the response by recording a 1kHz followed by a 16kHz or 18kHz test tone at 0VU from a CD test disc, and use the inbuilt level display to optimise the overall record/play response of the TD420 with any tape of your choosing.

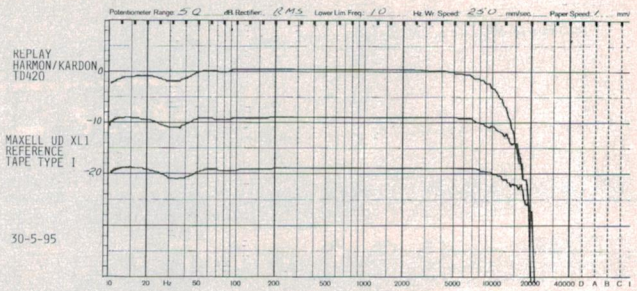
The record/play response of the TD420 is equally impressive with other tape formats. I evaluated samples of many of the most commonly used tape formats from Maxell, TDK, Sony and BASF. As you will see, the BASF Chrome Dioxide II, the TDK MA or Sony Metal Master Type IV tapes all produced a generally similar high frequency response, and all of those responses are good. When you consider that this deck has an RRP of only $599, then this record/play performance is particularly good.

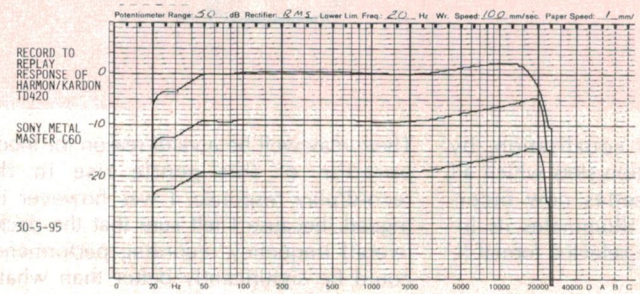
I proceeded further with the evaluation of the deck's record/play frequency response, firstly with Dolby off and sub-

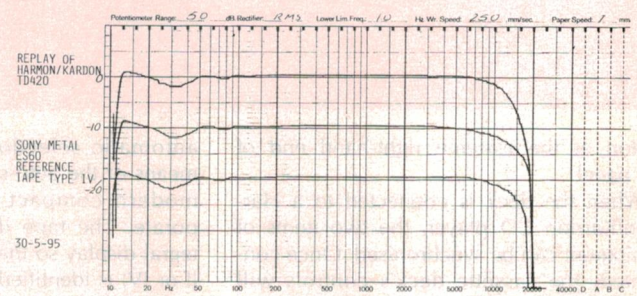


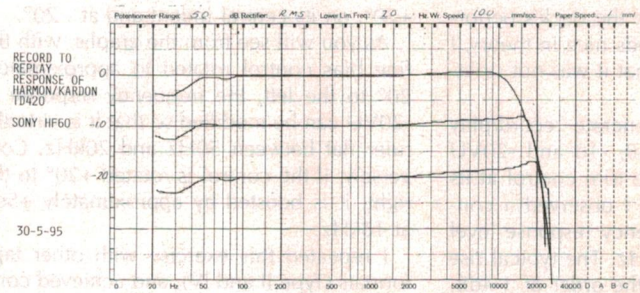
Although the TD420 has a rollout cassette tray, its heads are easily accessible for cleaning simply by removing the small clip-in cover on the top of the case.

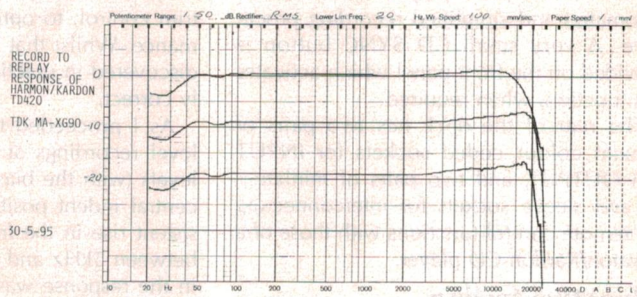


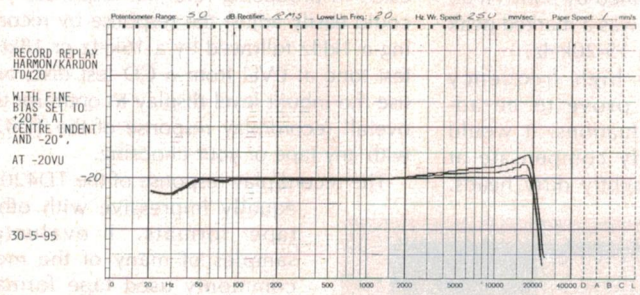


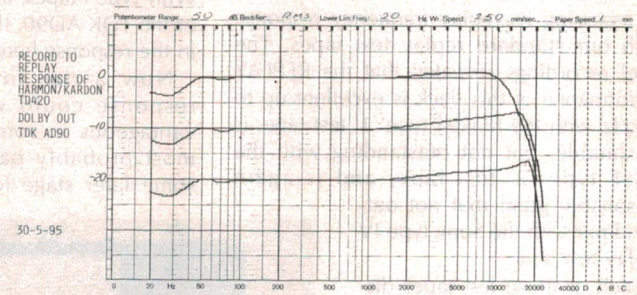


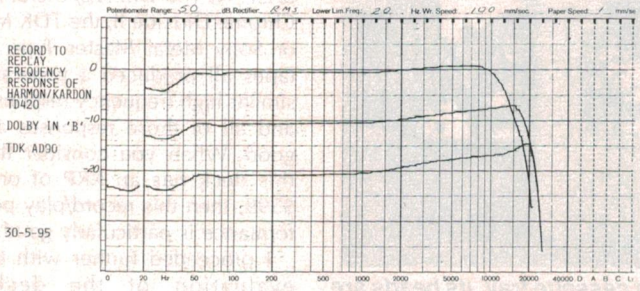




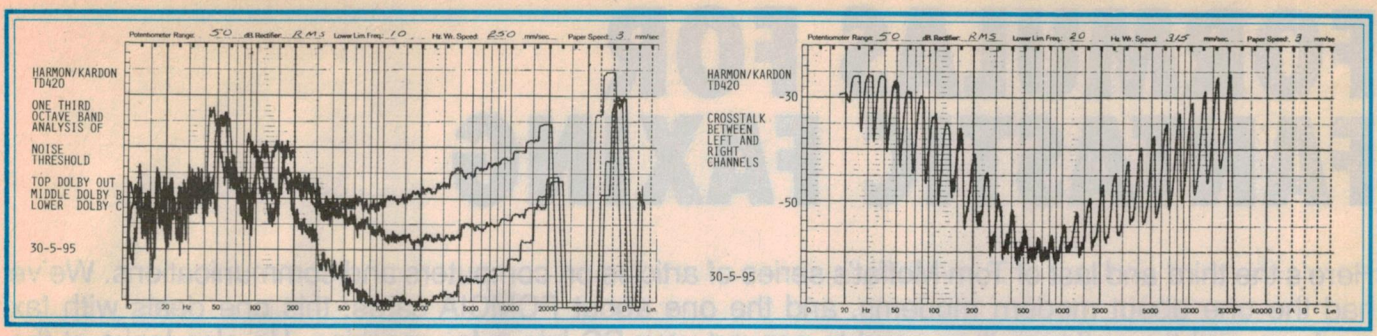








The six upper plots in this group show the record to replay or replay only response of the deck with various grades of tape, and at various levels. The lower curves show the effect of manual bias adjustment, Dolby disabled and Dolby B noise reduction.



Two further curves for the TD420, one showing the one third octave band noise analysis for Dolby out , Dolby B and Dolby C in operation (left), and the other the cross talk between right and left channels — typical for a two-head machine.

sequently with Dolby B and Dolby C noise reduction systems activated. Whilst there was a perceptible change in the overall non-linearity of the response, the magnitude of these changes were quite modest.

The channel crosstalk characteristics of the TD420 deck ranged between -26dB at 20Hz, dropping down to -57dB at 800Hz, and then rising back up to -26dB at 20kHz. These crosstalk figures are typical for a two-head machine, and although the numbers may not look impressive, the results are nonetheless quite acceptable.

A comparison of the unweighted, A-weighted and one third octave band noise thresholds of the record/play response with Dolby off, versus Dolby B and Dolby C was also interesting. The A-weighted noise threshold is -54dB(A) with Dolby off, -63dB(A) using Dolby B, and -69dB(A) with Dolby C activated, relative to 0VU level.

The performance with Dolby C noise control activated is quite impressive. The quality of low level noise generated, although not really on a par with either the DCC or Mini Disc systems, is still significantly better than required for a jogger's Walkman, or even for replay though your car radio/compact cassette player.

The speed accuracy of the deck was also extremely good, being a modest -0.06% from absolute speed. The measured wow was very low at 0.05% peak-to-peak. However the flutter was somewhat higher, with its unweighted figure being 0.6% RMS. The weighted flutter figure is however somewhat better, at 0.2% RMS. Both the weighted and unweighted flutter figures are higher than indicated by the manufacturer's specification data, and were bordering on the audible on some pre-recorded music.

The erasure ratio on Type I tape is exceptionally good at -83dB, whilst with Type IV tape (TDK MA-XG90) it is still excellent at -75dB. The measured harmonic distortion figures at -0VU and at -6VU are quite acceptable. The 3% third harmonic upper limit for recording with a Type I tape is +3VU. Provided the TD420 deck is used with peak levels below +3VU, harmonic distortion should not be a significant issue in the quality of the tapes it records.

Measured Performance of Harman/Kardon TD420 Serial No. 1.008-04272

Speed Accuracy -0.06%

Record to Replay Frequency Response at -20VU

Tape Format	Brand Tested	Lower -3dB Point	Max.Point & Frequency	Upper -3d Point
Type I	Sony HF60 and	20Hz	18kHz	21kHz
	TDK AD90		18kHz	21kHz
Type II	BASF Chrome Maxima	22Hz	19kHz	22kHz*
Type IV	Sony Metal Master	22Hz	19kHz	23kHz*
	& TDK	20Hz	18kHz	22kHz

* Max output of these tapes > +3dB above the reference level

Wow and Flutter	Wow	Average	0.05% P-P
	Flutter	Unweighted	0.6% RMS
		Weighted	0.2% RMS

Harmonic Distortion: Tape TDK AD90

Recording Level	Harmonic Component	100Hz dB	1kHz dB	6.3kHz dB
OVU	2nd	-	-46.6	-
	3rd	-44.7	-41.4	-37.3
	4th	-63.5	-	-
	5th	-48.0	-52.1	-
	THD	0.72%	1.0%	1.3%
-6VU	2nd	-48.3	-49.1	-43.3
	3rd	46.5	-45.2	-
	4th	-	-	-
	5th	-57.9	-	-
	THD	0.77%	0.65%	0.68%

Maximum Input Level (for 3% Third Harmonic Distortion at 333Hz)
Tape: Type 1 (TDK AD90) +3.0VU

Dynamic range:TapeType 1 (TDK AD90)

Dolby OUT	-45.0dB(Lin)	-53.2dB(A)
Dolby in 'B'	-49.0dB(Lin)	-61.0dB(A)
Dolby in 'C'	-50.0dB(Lin)	-67.5dB(A)

Erasure Ratio for 333Hz signal recorded at 0VU

Tape: Type 1 (TDK AD90)	-83.0dB
Tape: Type IV (TDK MA-XC90)	-75.1dB

Subjective tests

I took the TD420 cassette deck home to assess its performance in a 'real-world' living room. I decided to evaluate a number of important practical characteristics. These included firstly recording tapes from CDs, and then performing an A-B test between the original material when synchronised to replay the cassette deck recording with the CD.

For the first of those tests I used a brand new disc entitled 'Spirit of Spain' (Sony SMK68351). This CD was locally recorded and features the music of Slava Grigoryan. Slava is the first classical guitarist to be signed up on a contract by Sony/CBS in the 30 years since John Williams was contracted by CBS.

Slava's rendition of Spanish guitar music is positively exciting. More significantly, his playing provides an exceptionally good basis for assessing the record/replay characteristics of each of the three different formats, namely CD, prerecorded compact

Continued on page 18

FORMULAS FOR FANTASTIC FAXING

Here's the third and last of Tom Moffat's series of articles on computers and communications. We've had the one about modern modems, and the one about PCMCIA cards; this one deals with fax modems and the software they need to convert your PC into a fax machine. He also looks at the Australian-designed Microfax unit, which lets you receive faxes without having to leave your PC turned on all the time.

by TOM MOFFAT

A couple of years ago I bought a fax machine and immediately declared I couldn't live without it. It quickly became my primary method of written communication, and I was soon using it to place all the orders for my kit business. Then I started using it for business letters, and as fax machines became more and more popular, it took over personal letters as well.

Now I CAN live without my fax machine (well, almost!) — because it, like so many things, has been superseded by a computer. Sitting here in front of this laptop, I can plug a telephone connection into a modem in the side, tap a few keys, and shoot a fax off to anywhere in the world in a few seconds, at a cost of a dollar or two. To do the same thing by mail would cost the same dollar, but take weeks instead of seconds. And, with a bit of creative messing about, I can make my faxes look like they came from a multi-national company instead of a small business...

The computer can receive faxes too, but it has to be powered up to do so. When my laptop is reposing in its case with its day's work done, it is definitely NOT a fax machine. So I have retained my original 'proper' fax machine for unattended reception.

But now even that problem can be solved by a fully electronic gadget, as you'll soon see.

Revealed: the fax modem

The fax modem is a truly marvellous thing. Here we have a little piece of electronic wizardry, sometimes no larger than a credit card, replacing the big desktop fax machine of the past.

'Modem' isn't really the right word, because a fax modem is a complete communications controller, filled with many 'smarts' of its own. How *much* smarts depends on the 'class' of the modem — 'Class 1' or 'Class 2'. Here's how they differ:

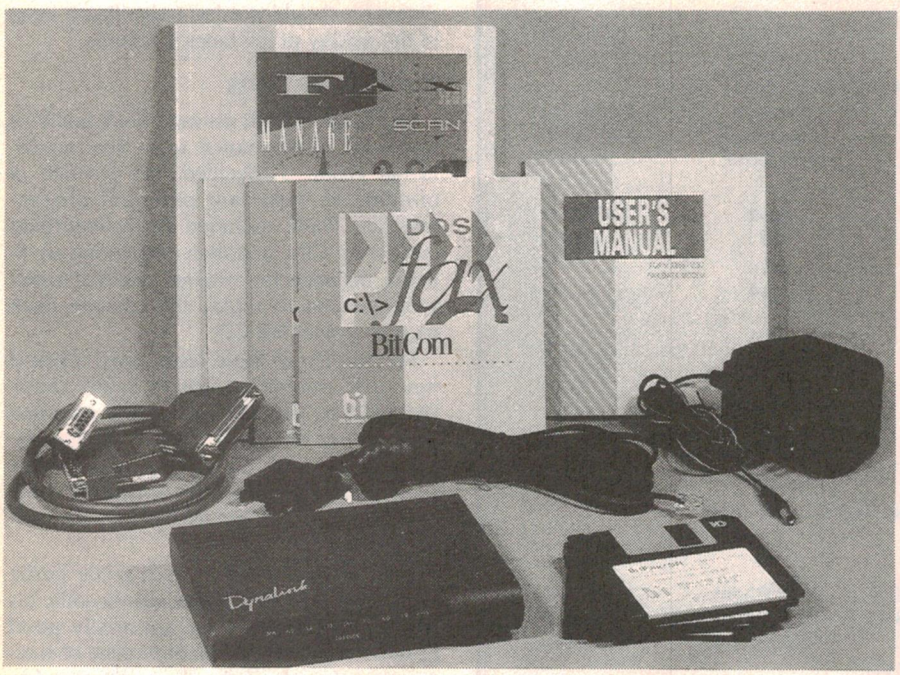
The purpose of any fax device is to send an image to another fax device. The image is converted into a common fax format known as T.4, and then sent to the other end via a session protocol called T.30, which handles all supervision and timing.

With Class 1 fax modems, the fax image formatting is done by the host computer, which then sends out the data byte by byte to the modem. The modem strips off start and stop bits and sends the remaining eight bits per byte as a synchronous data stream. The computer is thus responsible for producing the T.4 image, as well as for generating the T.30 protocol to send it on its way.

With Class 2, the host computer generates the T.4 image and then blasts it out to the modem a whole page at a time. The modem must handle the T.30 protocol. So with Class 1, it is mainly the responsibility of the host computer's fax software program to communicate properly with various fax machines. With Class 2, most of the responsibility lies with the fax modem.

If everything is working properly, the fax machine on the distant end wouldn't have a clue if your computer and fax modem are running Class 1 or Class 2. The results, by the time they hit the telephone line, are the same. The big advantage of a Class 2 fax modem over Class 1 is that it takes some of the workload off the computer.

If your computer is a high-power



Many of the latest modems come complete with data and fax communications software, to get you going. The Askey 'Dynalink' model shown here comes with DOS packages BitCom and BitFax, plus BitFax Professional for Windows.

machine running several tasks under Windows and trying to send a fax in the background all at the same time, Class 2 would offer a real advantage. But a less elaborate computer would be sending or receiving a fax as its only job, while you sit back and have a slurp of coffee. In this case, you'd never notice a difference between Class 1 and Class 2.

The fact of the matter is that Class 1 is ancient history (all the way back to 1988!), and Class 2 is new technology. Older modems support Class 1, current modems support both Class 1 and Class 2, and future modems (some present ones too) will support Class 2 only. At the moment there are sometimes compatibility problems between different versions of Class 2 — some software won't work with some modems — but this is being sorted out.

Both Class 1 and Class 2 fax modems are controlled by the same kind of 'AT' commands used for Hayes-type data modems (see my article in the December 1994 *EA*: 'Making Modems More Meaningful'). Commands for fax control begin with 'AT+F...'.

Using a data communications program, you can investigate the innards of your fax modem to see what classes it supports. To do this, type 'AT+FCLASS=?' You may get an response back on the screen such as '0, 1, 2 OK'. This means your modem supports both Class 1 and Class 2 fax, as well as normal data operation (Class 0). Another newer modem might respond with '0, 2, OK'.

Just for fun, you can switch your modem into fax mode by typing 'AT+FCLASS=1' or 'AT+FCLASS=2'. You can verify that the modem has switched by typing 'AT+FCLASS?' (note no equals sign) and it should respond with '1' or '2'. If you type 'AT+CLASS=0' you will be back in data mode where you started. Should you type 'AT+FCLASS=?' and be rewarded with ERROR, you've got big problems; your modem is not a fax modem at all!

Unlike the situation with data modems, it is not the done thing for the user to manually issue AT+F commands. This is always done by the fax software, and there's nothing to gain by trying to take command yourself. The first thing your fax software does is change your modem to Class 1 or Class 2 operation with a command such as 'AT+FCLASS=2'. From then on the whole procedure runs on autopilot.

As for data speeds, the computer communicates with the fax modem at 19,200b/s. Speeds between modems are nowadays either 9600 or 14,400b/s maximum, with fallback to lower speeds if communication is difficult.

Some modern fax modems come in the very compact PCMCIA 'plug-in card' package, for convenient use with a laptop computer. This unit from Charter Pacific Communications also works with a cellular phone.

At this stage there doesn't seem to be a big advantage in having a 14,400b/s modem. I've tried several of them, but in all the tests I did, they never connected with a fax machine in the 'real world' that could do better than 9600b/s. However this is certain to change in the future.

How computer fax works

Computer fax, compared with the traditional method, has two big advantages. One is that you don't have to keep feeding it those expensive thermal paper rolls. The other advantage is that, since the fax image is computer generated, it is of much higher quality than an image scanned optically from a piece of paper.

For those who haven't yet made acquaintance with a fax modem, there are two basic ways a computer can send a fax. In the simplest method you feed any text file, such as a letter you've typed, into a special software package which turns it into a fax image file. The program then uses the fax modem to telephone the destination fax machine or another modem, and then it sends the image file.

More elaborate fax programs, particularly those running under Windows, act as a substitute printer driver. So you first prepare a document (a fancy text file) using your word processor, and then tell the word processor to print the document. The computer will offer you a selection of printers, perhaps a laser or an ink-jet, and among them will be 'fax modem'.

You tell the computer to print to the fax modem, and a window pops up asking for details such as the destination telephone number. With this information supplied, transmission of a fax image begins — although the word processor still thinks it's hooked to a paper printer.

What comes out of the fax machine on the other end is exactly the same thing that would have come from a printer on *your* end, and the resolution can be up to 200 dots-per-inch, not too far from laser printer quality. If you wrote your document under *Word for Windows*, for instance, your fax could have a snazzy letterhead, several elegant character fonts, and even pictures. And since your fax 'printer driver' can work from any application that can print to paper, you can send images from things like drawing packages or even from PCB design software.

As for *receiving* faxes, the computer collects what is coming from the modem and assembles it into a fax image file identical to the outgoing image file format. You can then view this image on the screen, print it on a paper printer, or, since it's just another image file, re-send it as a fax to somebody else. You can of course 'view' an outgoing fax before actually sending it. It is somewhat embar-

rassing if the wrong person gets the wrong fax! (I know from experience...)

Of the two faxing schemes mentioned above, the 'printer driver' method at first sounds like the only way to go. But there are drawbacks — speed and complexity. Once you give the command to send a fax from within a Windows application such as *Microsoft Word*, the hard disk starts spinning, screens flash on and off, and dialog boxes pop up asking you to respond several times before the computer finally gets around to dialling the recipient on the other end. Then, once sending starts, you sit there watching the clock tick over as your fax dribbles up the line. And if it's a trunk call, your money dribbles too.

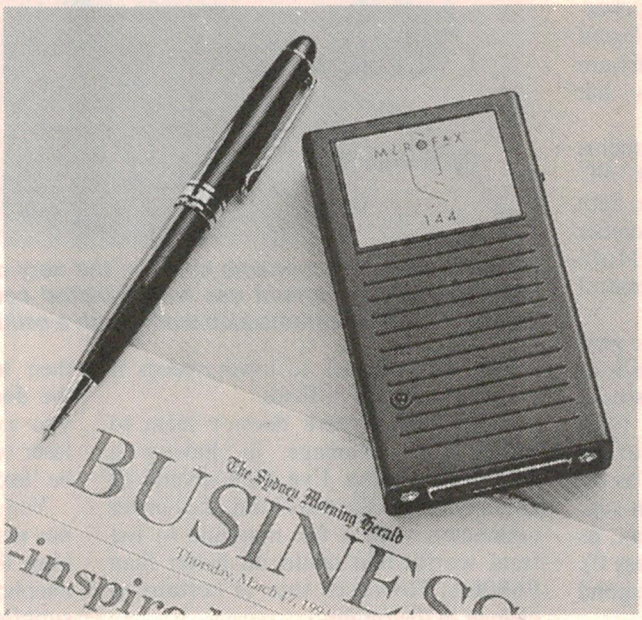
I have two faxing programs installed in my Toshiba notebook computer. One is a DOS-based package, an early version of *Quick Link II*. The other is a rather nice Windows effort called *Eclipse Fax*. To test them head-to-head for sending speed, I haywired a connection between a fax modem and a Kambrook fax machine, isolated by a 600 to 600 ohm line transformer. It was necessary to apply a little DC 'talk battery' to the Kambrook via the transformer winding before it would believe it was hooked to a phone line.

I arranged for both programs to send identical one-page faxes to the Kambrook fax, in the highest resolution mode. *Quick Link II* completed the fax in one minute 42 seconds. *Eclipse Fax* took 2:08 of telephone time to do exactly the same job.

This taught me that if there's a choice, it's cheapest to use the DOS-based system. However *Word for Windows* can produce some very impressive documents, so when I am sending a business fax to a company for the first time, they always get a Word document via *Eclipse Fax*. This is called 'making a good impression'. Once they have realised what a brilliant fellow I am, I can revert back to my text-based word processor and *Quick Link II* for further communication.

It is possible to fiddle the system in unofficial ways, and get DOS-based faxes looking almost as good as the Windows product. In fact for something that will be faxed many times, you can spend a little time and come up with a Windows document that can be faxed from DOS. An example is the list of products for my kit business, which gets faxed out again and again.

Most fax programs have the ability to convert back and forth between their own file format and the popular graphics formats. In the case of *Eclipse Fax* you can tell it to 'print to file' such as the popular .PCX graphics format, instead of actually sending a fax.



Australian made, the Microfax is very compact but is a self contained fax receiving unit, which allows you to receive faxes even when your computer is turned off.

My product list was written under *Word for Windows* as a file called 'PRODUCTS.DOC'. It used many of Word's fancy tricks to produce a result that looked almost typeset. The completed file was printed in the normal way and then photocopied for distribution by post.

To produce a fax version, I printed it again, this time to the 'fax modem' instead of a paper printer. But instead of specifying a phone number, I told *Eclipse Fax* to instead 'print to file' with the file type .PCX. What we now had was a 'picture' of the document, PRODUCTS.PCX.

After shutting down Windows I fired up *Quick Link II* under DOS, and told it to convert PRODUCTS.PCX into a fax image of its own file format, QFX (for Quick Link Fax). So we soon had a *Quick Link II* file called PRODUCTS.QFX. Now whenever I want to fax out a product list I just tell *Quick Link II* to send PRODUCTS.QFX.

The speed test mentioned above was made by using *Eclipse Fax* to send PRODUCTS.DOC under *Word for Windows* in the usual way. Then PRODUCTS.QFX was sent directly from *Quick Link II*. The times recorded were the actual on-line times, not the times to convert the files prior to sending.

Most fax programs allow you to include a graphic as part of the fax image. You can use this to stick a letterhead at the top of your fax, and your signature at the bottom. You can use a DOS or Windows drawing package and a bit of ingenuity to generate the images, and then convert them to your fax program's graphics format.

It is nice to have some kind of picture or logo in your letterhead. You can use 'canned' clip-art, but a better way is to start off with something original on paper and then scan it into the computer. If you do not have a proper scanner, fear not — just draw them nice and big and then have someone with a fax machine fax them to your computer. After all, a fax machine is nothing but a scanner and fax modem combination.

I used *Windows Paint* to produce two letterheads, one for my 'High-Tech Tasmania' electronics business, and the other for 'Tom Moffat — photo journalist and technical writer'. These contain graphics scanned from a book about 'modern' technology, published in 1878. The High-Tech letterhead features an image of an open-wire telephone line (communications). The other has two images, one of a fellow taking a picture with an enormous tripod-mounted camera (photo) and the other of a clunky old Remington typewriter (journalist).

The letterheads use big fat text fonts, chosen from a selection of 140 I keep under Windows. The overall effect is an amalgam of the old and the new, and they look pretty impressive if I do say so myself! As many would know I'm not a real fan of Windows, but sometimes it does have its uses...

Both letterheads, and a scanned-in signature, were converted to *Quick Link II*'s .QFX format so they can now be in-

cluded in faxes sent under DOS. As for text, programs like *Quick Link II* have their own very nice character sets complete with bold and italics. The overall effect, as I said, is very nearly as good as the Windows method and it's certainly a lot simpler, and cheaper on phone charges.

What about fax cover sheets, you say? I say let's start a campaign to have them banned. What good is a cover sheet anyway? Current wisdom says that every fax should have a cover sheet showing who the fax is from and who it's to. But isn't it easier to have who it's from on a letterhead? And as for who it's to, how about the traditional 'Dear Mr Frogbrains'?

Maybe cover sheets were intended to shield a fax from prying eyes. But a fax comes out of many machines in a long roll, not as one sheet on top of another. All a cover sheet really does is ensure that a one-page fax takes two pages to send. I once received a fax preceded by a full-page cover sheet which was totally blank except for right in the middle — where, in small type, it said '(cover sheet)'.

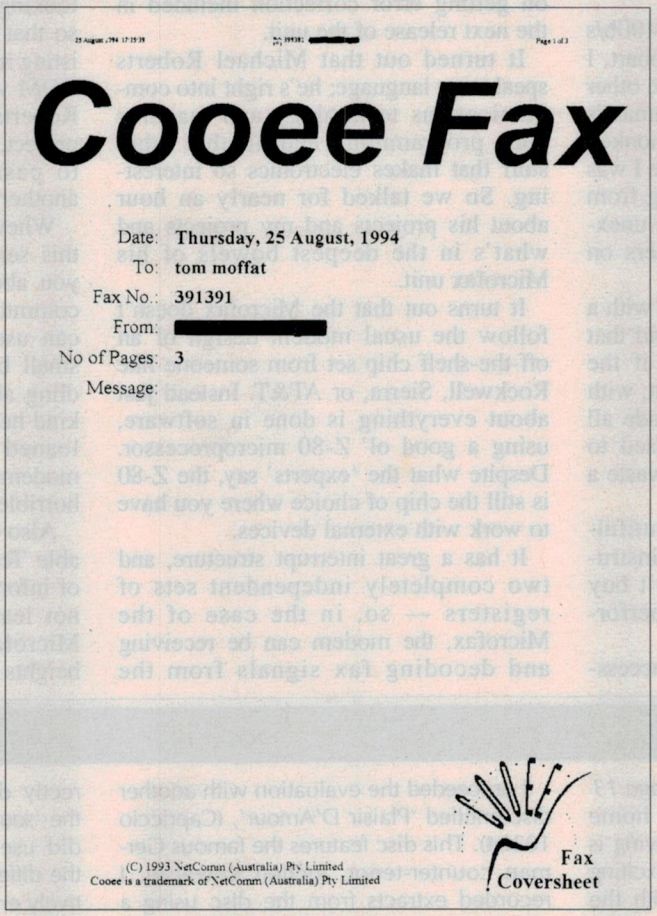
Sometimes fax software is thoughtfully provided with a ready-made cover sheet, and you only have to fill in the name and address. But then the cover sheet turns out to be an enormous commercial for the fax software supplier. An example I recently received is shown herein...

Speaking of fax software, there's heaps of it on the market, ranging in price from under $100 to several hundred. But if you buy a fax modem, chances are both data and fax software will come with it. With something like the current version of *Quick Link II*, the data and fax functions are all in the same package, and it has 'branches' that run under both DOS and Windows.

The ads say 'This modem comes with Blah-Blah-Blah fax and data software', but what they don't tell you is that you'll be getting 'crippled' versions. It's really only a free sample, and you're encouraged to spend some more dollars to upgrade to the real thing.

In the case of *Quick Link II*, one thing missing is the Zmodem part of the communications package. Zmodem just happens to be the most popular and useful file transfer protocol in use today. The *Eclipse Fax* version I have is a 'special edition', which means that it is missing a few features such as image enhancement and support for a scanner. But they remind you that these things are available by putting entries for them on various menus, and then dimming them out so they don't work.

For my own use I'm not too fussed about scanning or image enhancement, but those unnecessary menu entries are a bit much.



Cooee Fax

Date: Thursday, 25 August, 1994
To: tom moffat
Fax No.: 391391
From: [redacted]
No of Pages: 3
Message:

(C) 1993 NetComm (Australia) Pty Limited
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Fax Coversheet

Some fax software packages will generate a cover sheet automatically, like NetComm's Cooee. The cover sheet tends to turn into an advertisement for the package...

The Microfax

As mentioned at the start, the biggest problem with a fax modem, compared to a fax machine, is that you have to leave your computer switched on if you are to receive any faxes.

Many people don't use their computers continuously while they're working; in fact many a computer can go for days at a time before there's a need to switch it on. So it's a pain to have to leave an otherwise idle computer running, just in case a fax comes in.

But now there's a rather snazzy alternative to both the fax machine and a computer with a fax modem. It's an Australian product called Microfax. And micro it is; a tiny black box the size of a pocket modem. The beauty of the Microfax is that you can leave it sitting there running, but your computer can be switched off.

When a fax call comes in the Microfax unit answers it, sends out the necessary tones to start the calling machine transmitting, and then it stores the incoming fax — up to 15 pages — in its 512K of internal memory. When you finally decide to turn the computer on, the Microfax detects its presence and transfers the faxes into your machine via the serial port. They can then be viewed on the screen or printed in the usual manner.

The Microfax also has a direct connection for a printer, in addition to the serial connection to the computer. If you leave a printer connected and switched on, any incoming faxes will be sent to the printer immediately. So what you have is the equivalent of a normal fax machine, only using your own printer instead of a built-in one. And instead of the usual thermal printer mechanism, the Microfax can use a dot matrix, bubble-jet, or even a laser printer for very high quality images.

The Microfax can operate as kind of a fax 'base station' for your portable office. Instead of using your main office computer to collect received faxes, you can telephone the Microfax from out in the field and command it to shoot back down the line into your waiting laptop, all the faxes it has stored. Or you can make it automatically redirect any received fax to a machine somewhere else. So if you're a real cheapskate you can spend the afternoon in someone else's office and command your Microfax to use up HIS fax paper.

The device requires a numeric password, sent as DTMF dialling tones, to enable its fax forwarding and redirection features.

The Microfax includes a data modem, just like other fax modems, but I found it to be a bit too basic to be of any real use. Unfortunately the Microfax does not have any error correction features, yet the more up-market version of the device supports 14,400b/s operation (the lesser

FORMULAS FOR FANTASTIC FAXING

model does 9600 fax and 2400 data). Phone lines are seldom rated above 9600b/s, and you are really depending on the modem's error-correction software to fix up the errors that inevitably occur when the lines are pushed to 14,400b/s.

File transfers using protocols like Zmodem are OK because Zmodem itself has error-correcting facilities. But when you're just swapping text back and forth, there are problems.

Using the Microfax for a 14,400b/s connection just across town in Hobart, I found that the bulletin board on the other end sometimes received my commands garbled, to which it responded 'monkey + typewriter = garbage'. And while I was sitting there waiting for something from the other end, I sometimes got an unexpected string of garbage characters on my screen.

I had tried all the other modems with a bulletin board in Sydney and found that they behaved perfectly, just as if the BBS had been in my own city. But, with several attempts, the Microfax made all the right noises, but totally refused to connect interstate. All it did was waste a lot of phone calls.

All in all the Microfax is a beautifully thought out and executed fax instrument, but at this stage I wouldn't buy one because of its limited data performance.

A lot of my work depends on accessing on-line services, and living at the end of the world in Tasmania this means a lot of interstate and overseas calls, which the Microfax data modem steadfastly refuses to do — for me at least. But as for later on...

I faxed the Microfax company to ask about the data-modem performance and soon received a phone call from Michael Roberts, the fellow who designed the Microfax. He said that he was working on getting error correction included in the next release of the unit.

It turned out that Michael Roberts speaks our language; he's right into communications technology and machine code programming and all that other stuff that makes electronics so interesting. So we talked for nearly an hour about his projects and my projects and what's in the deepest bowels of his Microfax unit.

It turns out that the Microfax doesn't follow the usual modem design of an off-the-shelf chip set from someone like Rockwell, Sierra, or AT&T. Instead just about everything is done in software, using a good ol' Z-80 microprocessor. Despite what the 'experts' say, the Z-80 is still the chip of choice where you have to work with external devices.

It has a great interrupt structure, and two completely independent sets of registers — so, in the case of the Microfax, the modem can be receiving and decoding fax signals from the telephone line while simultaneously driving a printer.

The traditional Z-80 system consists of the micro itself, a programmable input-output chip and possibly a serial UART chip. Each of these is a 40-pin IC. But the latest version of the 'obsolete' Z-80 has all three IC's, plus more, on a tiny surface-mount chip.

All the jazzy software is contained in ROM at the moment, but Michael is looking to change this to flash memory so that the end-user can upgrade an existing modem's software by re-writing its ROM via the serial port. Given Michael Roberts' enthusiasm for the Microfax project, I'm sure these things will come to pass, and I've arranged to have another look at the enhanced model.

Whew! I think we've got to the end of this series now. I hope it's enlightened you about some of the latest computer communications gadgetry, and ways you can use it best in your home or your small business. All the testing and fiddling about was only possible with the kind help of Netcomm and Banksia who loaned their latest PCMCIA fax/data modems (if they'd only seen some of the horrible things I did to them...)

Also thanks are due to Advanced Portable Technologies who helped with lots of information on modems. And last but not least, to Michael Roberts and his Microfax, and may it reach the great heights it deserves. ❖

CHALLIS REPORT

Continued from page 13

cassette (Sony SMT68351), and home recorded compact cassette. His playing is outstanding, and it is even more exciting when you synchronise the CD with the home recorded compact cassette.

Yes, I could detect the difference, but it was nowhere near as great as I might have expected. I found it was particularly difficult to detect when the frequency response was adjusted to be ruler flat.

What I soon became aware of, were the differences in the noise threshold between the CD and the cassette tape. I could also detect the differences in level of distortion on the guitar's staccato peaks.

I then inter-compared the prerecorded 'Spirit of Spain' cassette with the home recorded cassette. The prerecorded cassette provided a fair performance. However the home recorded cassette provided a significantly better performance, particularly at the top end of the frequency spectrum.

I proceeded the evaluation with another disc entitled 'Plaisir D'Amour', (Capriccio 10324). This disc features the famous German counter-tenor, Jochen Kowalski. I recorded extracts from the disc using a new Sony Metal Master Type IV tape with its unusual heavy ceramic composite shell. The record/replay A-B comparisons really tested my hearing, as I again experienced some difficulty picking the difference between the original and the copy. Yes, there were differences, but I simply couldn't immediately pick which was which.

I repeated the exercise with an unusual disc from ABC Classics, 'Handel Arias from the Operas Alcina, Julius Caesar and Rinaldo' (ABC 446 272-2), which features Graham Pushee as the counter-tenor.

I again experienced some difficulty in correctly identifying what was 'source' and what was the 'copy'.

With careful listening I was able to correctly discriminate the taped copy from the 'source'. However, I must admit that I did use supplementary clues, including the differences in noise threshold, to positively ensure the correct answer.

Conclusions

At the end of a three-week assessment of the TD420 cassette deck, I came to the conclusion that it offers above average performance, features simple and user-friendly controls, and provides a level of performance likely to satisfy 98% of your potential requirements. This is one cassette deck which was worthwhile auditioning.

The Harman/Kardon TD420 Cassette deck measures 442 x 320 x 126mm (W x D x H) and weighs 5.4kg. As mentioned earlier, it has an RRP of $599. Further information is available from distributor Convoy International, of 400 Botany Road, Alexandria 2015; phone (02) 698 7300. ❖

'2dF' NEARS COMPLETION

An instrument developed by scientists at the Anglo-Australian Observatory is providing valuable information on the precise location and movement of galaxies in the universe — at a much faster rate than was previously possible.

by GEOFF MCNAMARA

One of the biggest questions facing astronomers at the moment is how the universe is structured. Astronomers need to find out exactly how galaxies cluster together, since this is directly linked with the origin and evolution of the universe. To make any meaningful sort of map of the universe requires tens of thousands of galaxy positions in three dimensions.

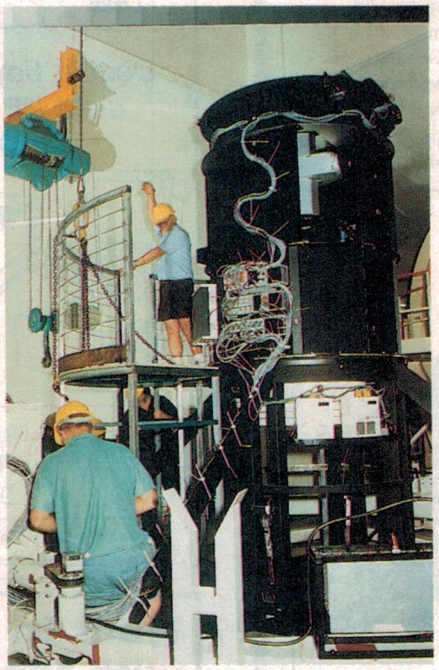
Finding the position of a galaxy in the sky is relatively simple — a conventional photograph will do. But finding the distance to the galaxies is a more complicated procedure, and involves observing the galaxies one at a time.

Until recently this has been a painfully slow process. Now a team of scientists at the Anglo-Australian Observatory have developed an instrument capable of observing up to 400 galaxies simultaneously. The instrument, called the 'two-degree field multi-fibre spectroscopic survey facility', or 2dF for short, has been designed for use with the 3.9 metre Anglo-Australian Telescope (AAT) in northern New South Wales.

2dF uses 400 optical fibres to channel the light from individual galaxies into two spectrographs, mounted on the side of the telescope. By examining the spectra produced, astronomers can work out the velocity and then distance to individual galaxies.

Because the universe is expanding, light waves from distant galaxies are stretched. This causes the spectral lines of known elements to appear shifted towards the red end of the galaxy's spectrum. Based on an estimate of the expansion rate of the universe, the amount of 'red shift' measured in a galaxy's spectrum gives an indication of its distance from us. This in turn allows astronomers to make 3D maps of the cosmos.

But 2dF does more than just observe lots of galaxies at the same time; it's been designed for maximum efficiency. For example, 2dF has an 'atmospheric dispersion compensator/corrector' (ADC) that gives the AAT an unprecedented (for a 3.9 metre telescope) two degree field of view. In addition, the ADC compensates for the way the Earth's atmosphere breaks up the light from galaxies by dispersing the light by exactly the same amount but in reverse — in effect, putting the light back together again.



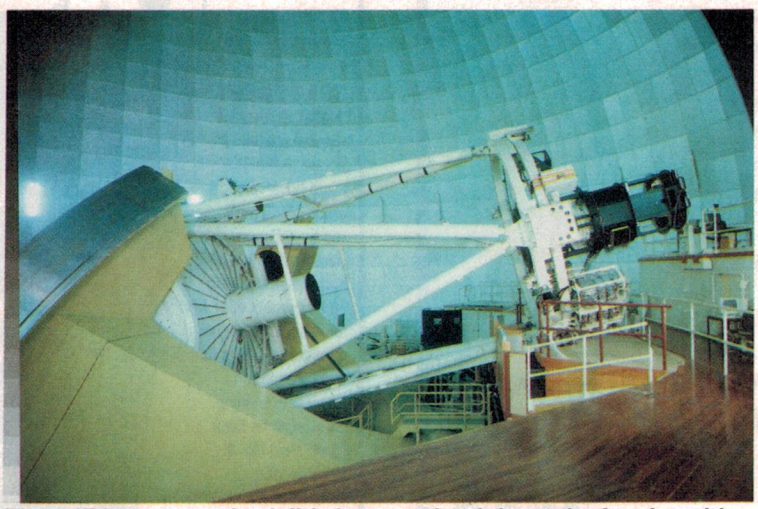
The 2dF instrument being prepared for installation on the 3.9-metre Anglo Australian Telescope.

In order to collect the light from individual galaxies, the tips of the optical fibres need to be positioned on a metal plate at the exact location of the galaxy's image produced by the telescope. Earlier versions of multi-fibre systems used just one set of fibres that had to be re-arranged for each new set of galaxies. To save time between observations, 2dF has two sets of fibres. While one set is being used, a robot prepares a second set for a different set of galaxies. The entire instrument, including the two spectrographs, is mounted on the top end of the telescope.

The AAO scientists say they can answer the big questions about large scale structure with about a hundred thousand galaxy redshifts, which they hope to collect within the first two years of 2dF's operation.

While the primary motivation behind 2dF was the investigation of large scale structure, during the five years that it has taken to develop 2dF astronomers have realised that it can be used in other areas. For example, astronomers will be able to use 2dF to distinguish between stars belonging to our own Milky Way galaxy and stars in smaller satellite galaxies.

2dF can also be used to detect the motions of stars at different distances from the galactic centre, yielding information on the evolution of stars at different places in the galaxy. The motions of stars in the galaxy will also yield information on the distribution of dark matter, invisible material that seems to make up 90% of the universe's mass. ❖



The 2dF instrument is visible here on the right, at the focal position of the telescope. The instrument was fully designed and built by a team of scientists at the AAO.

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THE SERVICEMAN

What do you do when a CTV has reached its 'use by' date?

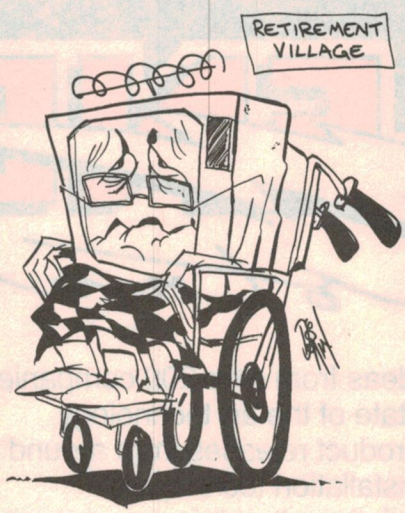
This month our Serviceman had to do a low-cost repair job on an elderly colour TV set which had in many ways reached the end of its economical working life — a job that couldn't be done, to his own satisfaction. He also presents a couple of stories from contributors, including one about a portable 'three in one' with a faulty component that was not only difficult to find, but also really hard to replace!

This month I'm going to start the column with some observations about a job that came into my workshop this morning. After I'd finished, I sat over a 'cuppa' thinking about the economics of the job and whether I had really been fair to the customer.

I wish there was some law that said 'This television is obsolete — dispose of responsibly!' In other words, some kind of 'roadworthiness test' for TVs.

It was an old Philips K9 chassis — a 26-inch, rotary tuner, VHF only set. The model was first on sale just before colour TV started in 1975, which gives you some idea of how old this one is. The complaint was that it would not switch off when they had finished with it.

When I asked for an explanation, I was told that they could turn it on OK, but after a night's viewing, they would press



the switch for off but nothing would happen. The set remained on for an indeterminate time, then turned itself off.

They had taken to turning it off at the wall each night, and always next morning the switch had reverted to the OFF position. This had been going on for some months and would have been tolerated for ever if the set had not decided to stop completely.

I was asked if I would fit a new switch and then look into why the set was no longer working. (Isn't it funny how the minor fault gets most attention from the owner, while the major problem is mentioned almost as an afterthought?)

The switch part was easy to fix. A squirt of silicone lubricant on the switch's nylon actuating lever soon had it working perfectly. I've struck this before, where the lever gets a bit sticky and the toggle spring is not quite strong enough to flip it over. A spot of almost any suitable lubricant will cure the problem, although I've found silicone to be the most reliable.

After I had fixed the switch, I turned my attention to the NO GO condition. This turned out to be another common fault with K9s, a shorted chopper transistor. Replacing the BU326A has never been one of my more popular jobs — the way it's mounted on the heatsink and so closely surrounded by other components makes for a very awkward exercise. However, it's a fairly straightforward sort of job, so it was eventually finished and the supply fitted back into the set.

I've always been a bit apprehensive when first firing up a new chopper in these sets. The breakdown might have been caused by a faulty control module U130, and if so the new transistor could go the same way. There is no easy way to test the module, so it's very much a case of 'suck it and see'!

This time I was lucky and the set started up quite normally. It was at this point that I began to think about that 'roadtest' idea. The picture was dull, flat and almost colourless. Even with the front panel controls full on, the picture was very little better.

To make matters worse, the picture was suffering from either top-foldover or ineffective vertical blanking. There were a number of teletext lines visible at the top of the screen.

My problem was this: I had done all that I had been asked to do — fix the switch and get the set going again. I had not been asked to sort out picture problems; yet as it stood, the picture was too bad for comfortable viewing, at least by my standards.

Up to this point, the job had taken about an hour and that was as much as it was worth. Even if I was lucky enough to solve the remaining problems in short order, it was likely to take another

hour — and would the customer be prepared to meet a big labour bill for such an old set?

I called the owner and tried to explain what I had found. But it seemed that she was either blind or never watched the set, because she didn't have a clue what I was talking about. However, she was prepared to spend a bit more than I had expected, so I was able to do another half hour's work before closing it up.

I started by brightening the picture slightly with R294, which sets the bias on the luminance output transistor. Just touching the trimpot made a big difference, so I suspect that a spot of dust or similar had get between the track and the rotor. I gave all the trimpots in that area a small squirt of contact cleaner, and things began to look markedly better.

At this point I could see a reasonable picture and realised that the weak colour was probably caused by poor tuning. The fine tuning knob was very tight, but eventually responded to some more of that silicone I had used on the switch. After that, it was an easy job to fine tune the available channels and readjust the colour control for a quite presentable picture.

This left only the retrace lines at the top of the screen. This could take a lot longer than I had already spent and since the owner seemed not to have noticed them, I decided that I wouldn't pursue the matter too far. There was just one quick test I could make, and if it proved positive, the repair would be just as quick.

This involved checking C265, a 22uF electro that brings vertical blanking pulses to the video amplifier. I have often found this capacitor low in value and this causes exactly the kind of fault that was showing here. In fact, this capacitor had been changed recently and the leads were cut off well clear of the board. This allowed me to clip a capacitance meter across the unit and take a measurement without having to unsolder it.

I would have been annoyed if I had gone to the trouble of unsoldering it, because the capacitor came in at 33uF — 50% over rating. So *that* was not the cause of the retrace lines.

There are other causes of retrace lines in K9s, but something about the picture made me wonder if this might not have been a case of vertical foldover, which allows a few unblanked lines at the top of the picture to appear lower down the screen. To check this I put my pattern generator on 'circle' and tuned the set to the output. This showed no sign of vertical non-linearity, so another idea had to be dropped.

By this time I had used up the customer's time credit, so I decided not to chase the retrace lines any further. I spent a few more minutes adjusting the height, width and convergence, then put the back on the set and called the customer to come and collect it.

I wasn't happy about returning the set with an obvious fault, but as I explained earlier, just how much will the customer pay for — and how much time can a technician give away as charity?

With any 20-year-old television set you are likely to find a dozen or more faults if you compare it against a modern set. How far do you go in trying to bring the oldie up to that standard? In most cases the owner hasn't noticed the other deficiencies, so I for one feel no great guilt in returning an old set in less than perfect condition.

As a footnote to this story, I found that after the set had been on for an hour or so, the retrace lines disappeared. So it had to be a thermal fault, and should have been relatively easy to track down. But the customer was happy with the set as it was, which is the aim of the game when all is said and done.

Last month I described a couple of old HMV sets whose fate was quite unambiguous — the owners said "Scrap 'em!". This month I have described a set that's in the same general condition, yet whose owner wants to keep it going... for who knows how much longer? As I said at the beginning, I wish there was some kind of road test for televisions.

Puzzling echo

Now for some stories from other people's workshops. First up comes one from a familiar contributor, Alan Leitch of Beverley Hills in NSW. You'll no doubt remember that Alan was a former telephone engineer and the story that follows comes from that period of his career. He calls the tale 'Little Sir Echo':

Before the adoption of DTMF (Dual Tone Multi Frequency) signalling on trunk circuits, there were various pulsed tone systems to convert the loop-disconnect dial pulses to signals which could be transmitted over carrier circuits. One of these was a system known as '1VF'.

This system employed an audio tone of 2280Hz, pulse width modulated to signal control and supervisory information over the carrier circuit. The generation and measurement of the tone bursts was performed by sequential relay logic using slugged relays, and the transmit/receive function was switched by a high speed DPDT relay (which operated and released in one millisecond!)

The 1VF relay set interfaced to the carrier system at the hybrid bay, where the two-wire circuit was converted to a four-wire circuit. This separated the transmit and receive paths using a pair of balanced transformers, connected in a bridge circuit with a balance network to form the fourth arm of the bridge.

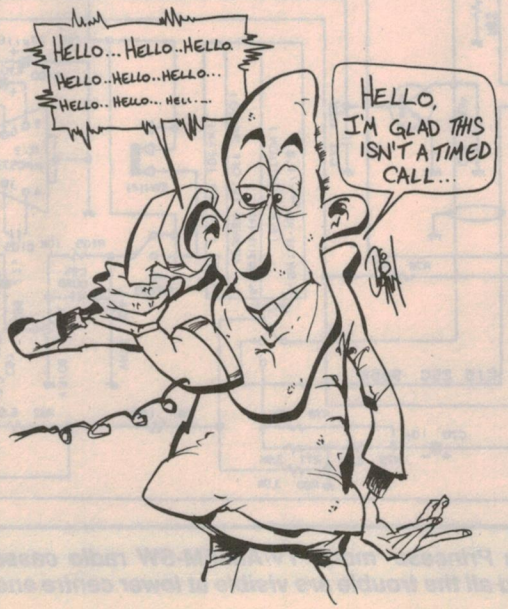
This arrangement provided 60dB isolation between the transmit and receive paths, and a 3dB insertion loss in those paths. Provided that the system levels are kept within tolerance and the impedance match between the two-wire point and the balance network is maintained over the bandwidth of the circuit, there will be no feedback or howling around the circuit.

On this occasion, the fault reported on this circuit was: 'Unable to dial the called party'. An attempt to call the distant end from the 1VF relay set confirmed the fault. Immediately the relay set was 'seized', it went into answer mode.

A monitoring amplifier was connected to the two-wire point and another attempt was made to call the distant end. The fault was still evident and a double ping, similar to a sonar pulse and echo, was heard.

This was most unusual as the only signal that should have been heard was a single 40ms pulse of 2280Hz. The 1VF relay set at the distant end was replaced by a substitute and the double pulse could still be heard. The two-wire point at the distant end was terminated with a 600 ohm resistor and the double pulse was still audible.

A spare hybrid circuit was patched in, and the fault condition



disappeared. Hahhh! a faulty hybrid. This was tested and the isolation between transmit and receive was found to be only 20dB instead of 60dB. The hybrid balance network, an RC unit of 600 ohms + 2.0uF, was replaced and the T/R loss increased to 60dB. Gotcha!

While the loss across the hybrid was sufficient to prevent oscillation, enough signal was leaking from the receive port to the transmit port and coupled with transmission delays on the long trunk circuit, caused the originating 1VF relay set to receive an echo of its own 'seize' signal, which was interpreted as an answer signal.

Well, that's not the sort of fault you'd be called on to fix every day, was it? Thanks, Alan. You have answered some of the questions that have puzzled me about telephone networks ever since I started working in electronics.

For instance, 'Full Duplex' in a radio service requires two distinct frequencies to separate transmit and receive. That would be the equivalent of four wires in a telephone circuit. Yet my telephone service does the job on two wires! How come? Well, Alan has explained most of that at the same time as he discussed a puzzling fault.

Thanks again, Alan. I look forward to getting more stories from you in the future.

Crippled Walkabout

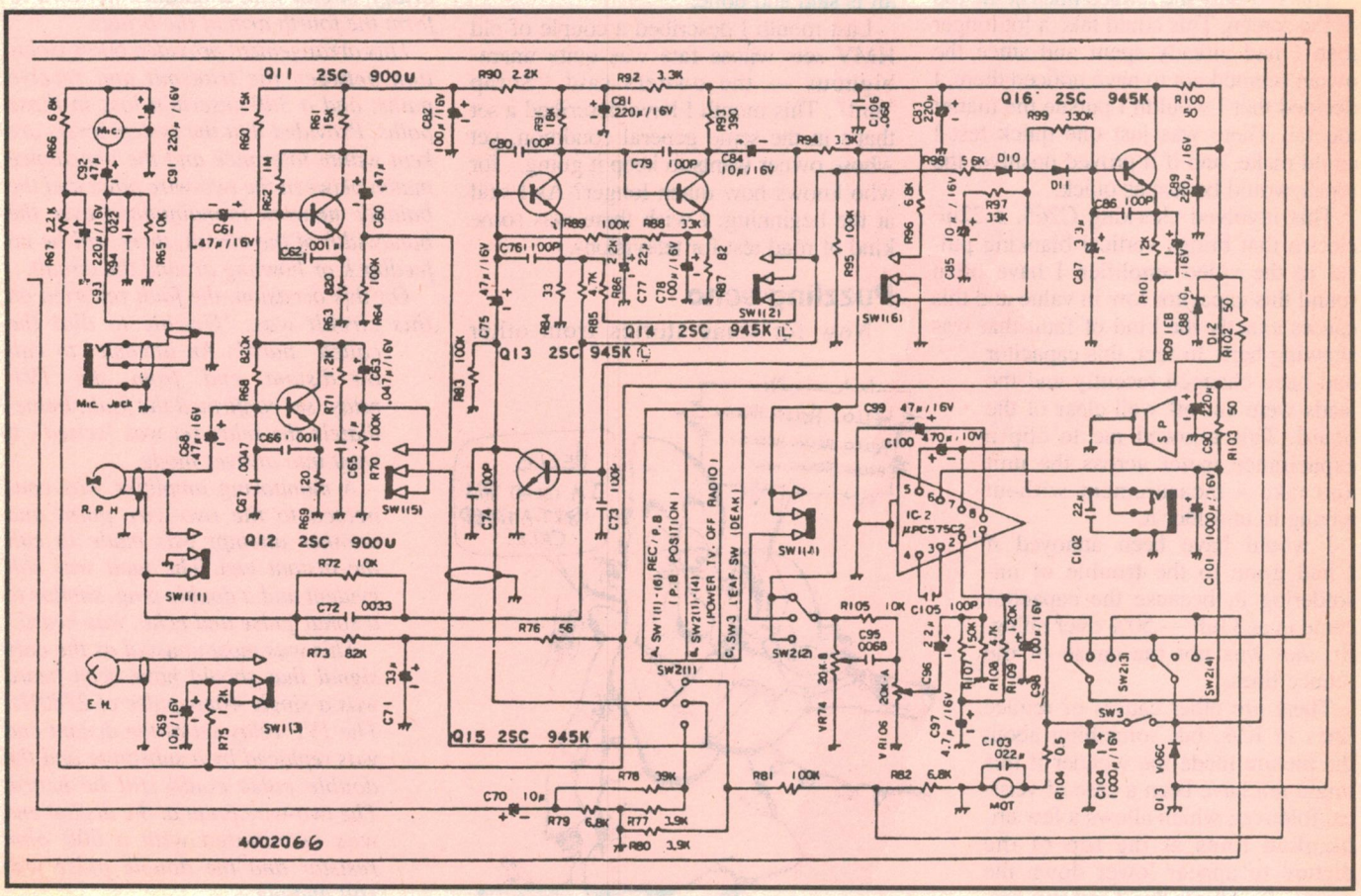
Now we come to our second contributor for the month. He is Norm Bush, from Canterbury in NSW. I think we had a contribution from Norm a few years back, so he is not a prolific writer. However, this story is an interesting one about restoring a radio/TV combination that looked as though it might be a write-off. Here's what Norm has to say:

A few years ago I was given a Princess 'Walkabout' to fix. It was a model TCR-53SGA, a compact (130mm) B&W TV with an AM/FM/SW radio and a mono cassette recorder. It can be powered by a 12V plugpack, a car cigarette lighter adapter, or on internal power from a set of nine 'D' cells.

I received the set with its original plugpack and was informed that both had been dropped. On checking the plugpack, I found the 240V primary was open circuit. A thermal fuse buried in the insulation had opened, yet the transformer showed no signs of having been cooked. Was the fall enough to open the fuse? That point is still a mystery.

I grabbed another plugpack and tried the set. It produced a perfect picture, but no sound. I had to send off for a circuit diagram, which arrived a few days later. This was for a TCR-53GAA, but was essentially the same circuit. As I started the job, I noted that the layout was very good with easy access to all three boards. All up, it seems to be a very well-made unit.

The main PCB contains the TV circuitry, with the radio PCB located above it. Each PCB is inter-connected via plugs and sockets, plus a few direct soldered connections. A separate and removable case section contains the cassette player, which also serves as an amplifier for the TV and radio. An inbuilt microphone is provided, along with two sockets for remote mikes. A three-position switch directs audio from the radio or TV to the cassette amplifier. The 'cassette' position of this switch also doubles as the main power 'off' switch. The switch also performs other vital functions, which I initially overlooked. With the presence of hindsight, I should have paid closer attention to its real importance. This would have saved me a lot of time...



Shown here is the audio section of a Princess 'mono TV/AM-FM-SW radio cassette recorder. The four poles of the triple-throw function switch that caused all the trouble are visible at lower centre and right.

I made several attempts to effect a repair, but all to no avail. Eventually, the owner decided that he no longer wanted the set, so its ownership was transferred to me and it was stored in my shed for something like four years!

Recently, faced with a wet weekend, I dug it out and started again. Apart from the switch, I suspected the cassette amplifier section; so this was my starting point. I removed and tested each of the resistors and capacitors in the signal path and although each checked OK, I replaced them just to be on the safe side. There were also some tone control and feedback components around the output IC, so I checked these too. Since I found nothing wrong with any of these items, I reluctantly decided that it must be the IC itself. So I replaced the upc575C2; but you won't be surprised to learn that there was still no sound!

Then a thought suddenly struck me! Was the audio getting through to the amplifier's input? To find out, I set up a small test amp I had constructed some years ago and soon found that there was good audio right up to and just beyond the input. Then it vanished.

This turned out to be a red herring, because the signals were there alright, but as you will see there was no DC supply to allow them to pass any further. Of course, I didn't realise this at the time and simply assumed that the failure was due to a faulty part not passing a signal. It never occurred to me that it might be a lack of power that was stopping the signal!

I was pretty desperate by this time, and the Princess nearly went Walkabout — back to the shed. I was fed up with it, and needed some kind of inspiration. Then the answer came to me, quite by accident.

As I pushed the Rad/Cass/TV switch into the TV position, the speaker suddenly burst into life. Only for a second or two, but long enough to prove to me that I had a functioning audio stage. Reference to the circuit diagram showed that, among other things, this switch also controlled the DC supply to the amplifier board — which adequately explained why there wasn't any sound.

The switch could be manipulated into making the sound come and go; which was strange, since it certainly didn't do that before. I wondered if I had accidentally fixed a second, previously unknown fault. But either way, I had no alternative but to replace the switch.

To gain access to the switch, a nylon frame holding the radio PCB is removed. Just four screws hold it in place, with an awkward one located below the front panel, above the TV board next to the tube. It's also nearly impossible to replace!

Most of the front panel controls come away with the radio PCB, including the switch in question. A few resistors and a capacitor are accommodated on a small PCB attached to the switch pins. I wasn't looking forward to removing the PCB, since it carried some very fine tracks and no less than 16 pins had to be unsoldered to release the switch.

Then, realising that the switch was useless anyway, I decided to amputate it before cleaning up the board. I unsoldered the four corner legs to the outer casing, then prised it off the board. Then I cut through the 16 pins, leaving their stumps protruding on the solder side.

I had a little trouble cleaning out the holes, but eventually succeeded by using a small drill bit. These little drills are actually welding torch nozzle cleaners, but are very handy for this sort of work. Each has a plastic knob on the end which makes them very easy to use. During the whole operation, I only lifted one small part of one track.

I had on hand several switches of the correct type (where was Murphy?) and the new one was easily fitted into place and the lifted track restored. Satisfied with my work, I re-fitted the radio PCB and switched on, whereupon the Princess sprang into life.

The rest of the story is a real tale of misery that I won't bore you with. I had no end of trouble getting the set to work with the cabinet back in place. Some of this was my own doing, and some due to plug and socket contacts that had never been designed for frequent dis-and re-assembly. However, the job was finally completed and the Princess has now been running for several days and hasn't missed a beat.

Looking back over the whole debacle, I think my biggest mistake was in failing to take a few DC measurements early on. This would have revealed 'No DC' on the output chip, and I would probably have been led to the switch much sooner than I was. I have spoken to the original owner of the set and told him that it is working again. He tells me that he has replaced the Princess with a similar set and does not want the old one back. So I am free to keep it, and a useful little set it will turn out to be.

Well, Norm, I hope the Princess turned out to be as useful as you wished it to be. And thanks for the story — I feel that there are several useful tips for budding servicemen among your words.

As you realised after the job was done, the very first thing one should do is to check voltages. I can't think of a single occasion where a voltage check, either AC or DC, would not be the first test I would make on encountering a faulty appliance. As you found out, Norm, testing components is pointless if there is no voltage to power them.

Then you used a well tested procedure to remove the switch. There are times when it is more economical to sacrifice a component, even a good one, than it is to repair or replace a damaged circuit board. The only thing I would question is your use of the small drills to clear the PCB holes. The usual practice among servicemen is to clean up surplus solder with desoldering braid. This product has the double advantage that it not only soaks up the solder, but also has the effect of rapidly removing heat from the area. This heat-sinking effect protects the board and tracks, and any other sensitive components that might be nearby.

Finally, your struggles to get the set to work with the cabinet back in place has a parallel in my attempts to repackage a video camera after repairing a dry joint. I'll tell that story another time, but I can really sympathise with Norm on this one. It seems almost as though manufacturers deliberately put a kink in certain cables, just so they will lie in the worst possible place for reassembly.

Thanks for that story, Norm, and I hope it will not be too long before we hear from you again.

That's all for this month. There is a pile of shortish contributions on hand, so I'll make up a medley for next month. See you then! ❖

AND NOW LIVE FROM CHINA - 3

Previously, we have seen how our team of Australian technicians and operators have spent three weeks setting up and rehearsing for a week of live broadcasts of the NBC Evening News and the Today show from China. This month Bryce Templeton concludes his story by describing how the actual broadcasts were done.

by BRYCE TEMPLETON

Now the time for the broadcasts was drawing near. The pace quickened considerably, and we began to get more serious about the OB. Things had started to go wrong with the Beijing truck, or to put it correctly, they had always been wrong — but until we really began to use the equipment, they had gone unnoticed.

We spent many hours repairing, or if repairs were not possible due to a spare parts problem, devising other ways of achieving the same result. Finally with two days to go the truck was moved to the Forbidden City.

The links were re-established and cables re-connected, and an army of Chinese carpenters appeared to construct a stand for the talent to sit on. Then a rehearsal was conducted of both the News and the Today show. The director wanted small changes — camera angles and the like — but it all seemed OK.

The lighting people had returned and so we went over to their hotel, The Sheraton Great Wall, to get some lunch. Bob and his boys were already installed in the snack bar, and we noticed that they had cans of Fosters. Feeling a bit homesick we ordered Fosters as well, but were amazed when the waiter told us that there was none.

"What about those?" we said, gesturing in the direction of the other table groaning under a load of blue cans. "Sorry, none", said the waiter.

A delegation was despatched to the lighting table and we heard a loud and angry conversation indicating that the Lighting crew had persuaded the waiter to reserve all the Fosters for them. After some minutes of genteel reasoning, they saw the error of their ways and lifted the embargo. So it was Fosters all round.

Back at the compound, it was noticed that a building just across from us had a room with a concrete dome roof which gave an amazing echo, to the extent that one could not conduct a conversation in there. The building housed a carpet market, but the dome room was vacant; so, purely in the interests of science, it was decided that a cracker should be let off in there to study the effects.

The largest banger in our collection was selected, and as casually as possible it was left fizzing in the room while we hurried out. The noise was like a 16-inch navy gun going off, and caused the carpet sales man and his customers great surprise. But it did satisfy our scientific curiosity, the conclusion being that a large cracker in an echo chamber makes an extremely loud noise.

So on the evening of the last fun day, we readied the small truck for the News crew to use early the next day and went home.

The first broadcast

On the morning of the first broadcast, we were dragged from our beds at an unreasonable hour and taken to the Forbidden City. Bus loads of make-up people, script assistants, director's assistants, various secretaries and assorted helpers had appeared, and there was great excitement building while we waited for the arrival of the talent: Jane Pauley, Bryant Gumble, and Willard Scott. The News had already been done, apparently successfully, and Tom Brokaw, the reader, was gone.

It is traditional in the television industry that no sign of interest must be shown by technical and production staff in the presence of 'the talent', no matter who they are or how famous. But we did sneak a couple of looks at them.

Endless rehearsals, changes, fiddles and movements took place over the next few hours, and, again as is traditional, the director and the production assistants worked themselves up to fever pitch. They took to throwing tantrums, and using phases like "I'll see you never work in this industry again".

The trick with this sort of thing is to remain as calm as possible, and attend to

Testing the mobile ground station, in Beijing. (Courtesy of G. Evans.)

the orders that are barked at you if they are practical or possible; otherwise it is best to maintain a low profile. The people concerned do revert back to their normal sweet selves once the pressure is relieved.

Unfortunately the American head of engineering took everything that emerged from the director's lips as a pearl of wisdom, and eventually had to be spoken to about the practicalities of rebuilding the OB at that late stage...

This was the day that there was an audience, so a couple of hundred chairs were arranged in the courtyard. The cables for the PA system were laid out once more and the speakers placed at suitable points in the courtyard.

Public address, especially for a live program, is something that is not looked on with great relish by audio directors. The audio of many OBs has been ruined by the PA feeding back, or causing a hollow or echoing sound. The usual arrangement is to split the microphones so that the on-air mixer and the PA mixer both get an independent feed of the same microphone. That way the two mixes can be separately controlled. The PA mixer also is fed with the insert material (the VTRs and the 'return' audio, in this case from NBC in New York).

The operator of the PA mixer, since he is in the audience, can hopefully do a mix that is loud enough to hear, but does not cause any unwanted effects on air. To do this successfully requires that the operator (me, as things looked at the moment) is in a position where he can see and hear what is going on.

The system was duly set up and checked, and it seemed that although more speakers would have been nice, the results would be satisfactory. So we busied ourselves with other aspects of the setup.

Director's directions

The production team arrived and soon the usual arguments were in full swing. I was shocked when I went back to the courtyard to find that the PA setup had been disconnected and completely changed. The director was adamant that the speakers must be much further out, the cables must be removed and the mixer must be banished to the back of the audience.

He would not listen to arguments that it may not work properly; the only compromise he would make was that the cables could stay, after it was pointed out to him that the PA would not work at all without them. So with time running out and the audience running in, I began to reassemble the system.

A pep talk to the crew from the director (white hair, back to camera), at the Bund in Shanghai. Note the ever present audience in the background. (Courtesy of G. Evans.)

I discovered that I could not see the stage from my new position, and I did not think I would be able to hear. But it was too late now and, with about half an hour to go, the PA burst into life again. The warm up and speeches went all right, but once we went to air, I was told in no uncertain terms by Steve, the audio director, to reduce the PA level. This resulted in the audience being unable to hear.

The problem was that the speakers were now so far away from the audience that if I ran them at a level that the audience could hear, the spill was getting into the microphones and threatening to cause the much-to-be-feared feedback. And, as I could not see who on the stage was talking, I found it difficult to open the correct microphone. Instead had to have them all open, so increasing the feedback problem.

I felt that since there were 20 million people watching the TV and only 200 on the local scene, I should err on the side of the 20 million — a view that was not universally held by the audience. In the end, one would have to say that it was a disaster, as only about a quarter of the audience ever heard the presenters, although the inserts were fine.

Apart from that, the program seemed OK to us, and again once it was all over, everyone reverted to their original personalities.

The no sleep era

The small truck had been moved to the Great Wall and readied for the next morning's Evening News, so our truck was now disconnected and handed over to the driver to be moved that night.

We had been told that we would spend the night at a rural hotel, to avoid the hour's drive to the Wall. This became more and more unappealing as stories emerged about these establishments, so at the last moment the troops revolted and made it clear that we wanted to stay in the Kun Lun and we would get up earlier.

As we were strolling home though the Forbidden City to meet our bus, one of the Americans leapt four feet into the air and came to rest beside a weed growing at the roadside. This, he announced in a hoarse whisper, was marijuana, and he proceeded to pull it up by the roots and hide it in his bag.

He later reported (still in a hoarse whisper) that he dried it with a hair drier and smoked it. I suppose it really was the evil weed, as we noticed no lasting change in his character.

When we had said that we'd get up earlier, we did not mean them to take us so literally. We were dragged from our slumbers at 4am and arrived at the Wall at about five, while it was still dark. We stumbled about in the dark still half asleep, trying to find the five or six Chinese labourers who were to help with the set up. Finally they were located under a pile of rugs, asleep.

Once we got them going they were invaluable. One produced the world's oldest forklift truck, and they started lifting loads of cables and lights that put us to shame. One particularly wiry gent of about 60 years old carried enor-

mous loads on his back, all the while smiling cheerfully.

The satellite folk had their bit set up, so there was a short break in proceedings while the News was transmitted using the small truck, with Tom Brokaw sitting on a wooden dais at the top of the wall, the dawn sky behind him.

Again the same procedure was followed, with our contentment being shattered with the arrival of dozens of the production team, who again became more and more heated as the day wore on. As air time got closer, more things were deemed to be unacceptable and had to be changed, and again words flew.

During the broadcast there was a failure in the talkback system that supplied Bryant Gumble with his earpiece feed, which caused him to fly into a rage. But apart from that it was a successful broadcast, and everyone was happy.

These faults that occur once the program is going to air are very difficult to fix, as one cannot take the chance of further disruptions. If an alternative path or system is available then it can be used, but often little else can be done.

The strike (dismantling of the OB) was much harder and more time consuming this time, as all the equipment had to be manhandled down off the Wall and packed into the trucks. So we got back to the Kun Lun quite late.

Bye bye, Beijing

The following day was our last in Beijing. As the OB site was quite close, we were allowed to sleep in a bit. We then had to check out of the hotel and place our luggage in a van ready for transportation to Shanghai that afternoon. Then it was off to Tian-an-men square. Sure enough the trucks were there and the setup procedure was again carried out. The rehearsals with the now familiar hysterics went on through the morning...

Then it was air time. I was again pressed into service as an audio assistant, checking cables and microphones, and generally helping to make sure things were in the right place at the right time. Greg had been encouraged to try his hand as a camera control operator, which involves colour matching the cameras and adjusting the iris.

In a remarkably short time it was over. All the ill feeling and remarks about other people's parentage of two hours ago were forgotten, and there was much back slapping and congratulations.

Now it was a sad time, as we said goodbye to the old truck that, all in all, had not done too bad a job.

We boarded our bus and headed for the airport. Things seemed to be going amazingly well — the plane was there, and we got on. Then we sat, and sat, and sat.

After about an hour, an NBC girl told us that they could not get all our luggage and the equipment on, so they were going to pack the equipment and leave some of the luggage until the following day. I have to admit that she was a brave girl to tell a plane load of cranky people that; but she escaped physically sound, if a bit red around the ears...

Again we sat and sat and sat. After another hour we were off, and without further incident landed in Shanghai. By now it was 1am and we were looking forward to at least a couple of hours sleep. But no, in an announcement that I thought marked the lowest point of the trip, engineering was told to be at the OB site at 2am.

Hectic Peace...

We really just had time to check in at the Peace, have a shower and change before we had to go across the road to the truck. Once there, we saw the reason for their concern. The American who had been left to install the equipment seemed to have not fully completed the job; in fact in the case of audio, he had not fully started it.

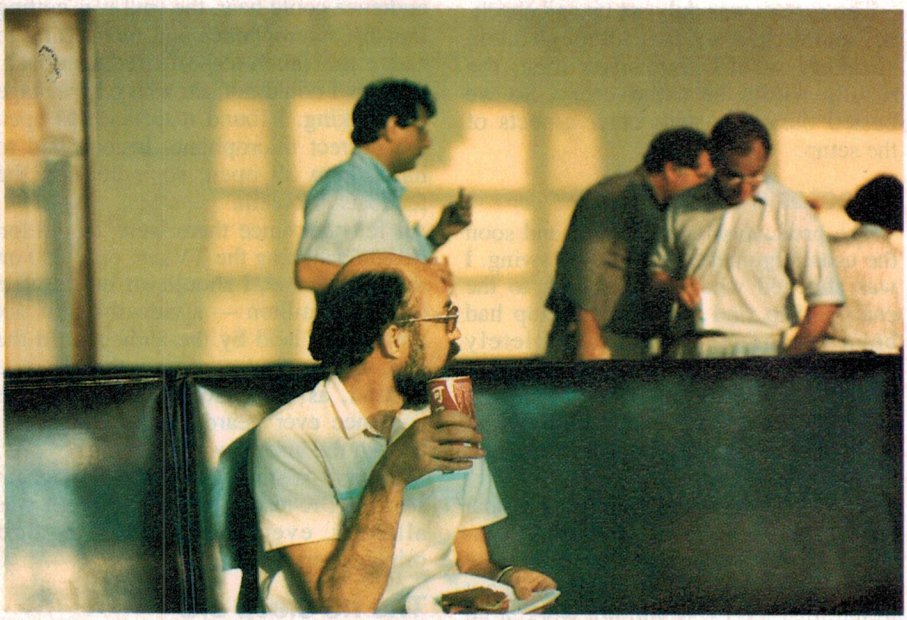
There was furious activity all night and into the next day. We checked the tape machines in the rear of the truck, and Greg changed his hat and became a VTR operator. Sitting outside balanced on a box, he didn't look too professional or comfortable; but it worked.

We were running around trying to find equipment that had come from Beijing, and placing unwanted equipment in our store van parked near the OB truck. Inside this vehicle was all manner of things, including a Conrac colour monitor that was sitting on top of a pile of road cases. With all the movement of the truck with people jumping in and out, the monitor worked its way to the edge of the pile and when the next person jumped on, it fell about two metres — landing face down on the steel tailgate.

We gingerly lifted it back, expecting to see an imploded tube at least. But no! Nothing, not even a broken knob, and it still worked. The Conrac has a cast aluminium frame, and I think it proved its worth that day.

Fortunately the News was out of Beijing this morning, as in Shanghai there was no second truck; everything was to come from the big truck. We bravely pressed on, and did get a working truck by mid-morning when the production team wanted to start rehearsals.

Naturally there were things wrong, but they wisely stayed away from engineering with their criticisms — preferring instead to request that the stage (which had been constructed by a large team of tradesmen) be dismantled and moved 50



Waiting, waiting, waiting. Lunch, including Chinese Coke, at the military base near Beijing while waiting for the long lost plane to Shanghai. (Courtesy of G. Evans.)

millimetres to the left, or something equally silly. Had there been any similar requests to us, I feel we would have got a verdict of justifiable homicide.

Language barrier

On this day there was to be an interview between Bryant Gumble and a Chinese official. This posed a problem, as Bryant's command of the Chinese language was restricted to menu items, and the other gent spoke no English. We therefore had to arrange for two simultaneous translators, one Chinese to English for Bryant and for use on air, the other vice-versa for the interviewee...

The translators were to sit in the comms van, and had to have headphones to listen to their respective speakers, and a microphone each, feeding earpieces on the talent so they could hear the translation. This seemed doomed to failure. The chances of a mixup, resulting in Bryant getting the Chinese translation and the Chinese interviewee getting the English, seemed close to 100%.

We checked and rechecked, marked the microphones and headphones with 'ENGLISH' and 'CHINESE', and made sure the correct feed came out of Bryant's earpiece. Still, we were very nervous when the time came to use it — but it worked perfectly!

The rehearsals and the program went well, or so I am told; it all seemed a blur. Then we were allowed to return to the Peace and get some sleep.

Event with a bang

I was woken at about 9pm by a tremendous noise outside, and went up to the office suite (which had a balcony) to see what was happening. It was apparently a celebration of Chinese National day, and as the Chinese are still allowed to have fun, they celebrate loudly using fireworks. Not the pretty flowery ones, but real men's bangers.

The whole of Nanjing Street, which runs past the hotel, was a seething mass of humanity, with much screaming and laughing and of course the fireworks. We decided to enter into the spirit of things and got our crackers that had been purchased on our last visit, and spent an hour hurling them off the balcony.

Now fully recovered from the previous day, we went downstairs to the famous Jazz club. This must be the oldest Jazz band in the world. The musicians are all at least in their seventies, but they play cool jazz as they have done for many years.

The whole of the Peace hotel is a time warp; when you step in the door you are whisked back 50 years. The decor is wonderful, the rooms large and old fashioned, with wooden panelling and 1920's furnishings. After some dinner and a couple of cleansing ales we retired again.

The next morning we had to get up early to do the News, and then continued our repairs and maintenance. We also set up for an interview at a site a couple of hundred metres up the river bank.

I was again to become an operator, and mix a couple of microphones and feed the result to Steve. We set up a small mixer and did tests, to be doubly sure that all was well. Then I went about my second job as an audio assistant.

The segment I was to do was only a few minutes long; nothing could possibly go wrong. Naturally as this was Shanghai, we were continually surrounded by hundreds of people. The director decided that he wanted them more animated, so he had Steve play music from the film *Dirty Dancing*, at a loud volume to kind of rev them up. I don't think they had seen that picture, as they just stood there and looked at him. Maybe it would have worked back home...

Power failure

We got under way with the show, and I sat at my mixer — checking, checking, checking. The time for my moment of fame was coming closer, when, with about 30 seconds to go, the power to my mixer went off. I sprung from my seat as if scalded, and raced back towards the truck following the mains cable.

Sure enough, hundreds of pairs of feet had succeeded in pulling an extension cable connection apart, right at the crucial moment. I plugged it back together and raced to my mixer, which had burst into life. Fortunately the camera had a microphone on it, so Steve was able to get some sort of sound until my mixer got going again.

Other than for this regrettable incident, the show was good. This 100% failure rate at my being an audio operator caused me to resolve to only do techo's work from now on...

The next morning I woke rather late, about 8:30am. I was just making my way to the OB site when to my surprise, I met the crew coming back. I was asked, in what I considered an excessively sarcastic and offensive way, where I had been. It seemed that I had forgotten the last News program that had gone out at 7am. Still, NBC put on a magnificent breakfast, and that seemed to calm everyone.

We returned to the site and pulled back a number of cables, removed the temporary platforms and extensions, and packed up the tender truck. The old OB truck went off to an unknown destination. It was rumoured that NBC intended to use it and its Beijing mate at the Seoul Olympics in Korea, but I never heard any more of that scheme.

Thousands of dollars' worth of cables were left in the gutter, for the local TV station to take, if they wanted them. That evening a 'wrap party' was held in the Sheraton Huating, and was much enjoyed by all.

Going home

And that was it. The next morning we were delivered to the Shanghai Airport and the following morning, after a day in Hong Kong, we were back in Sydney — having endured first class travel again, probably for the last time in my life.

It was probably one of the last times an OB was done in such a lavish style. The Today show still occasionally travels, but it seems on a reduced budget now. The NBC effort at the Olympics in Barcelona may have set some sort of a record however, as they built their own McDonald's for the crew's canteen.

The trouble is, now that network management wants these OB's to show a profit, the amount of money available for having fun is much reduced. Not much point in doing them if you can't have fun, is there? ❖

Build your own set of...

HIGH QUALITY VIFA TWO-WAY SPEAKERS

Jaycar's new range of Vifa-based kit loudspeakers includes this compact two-way system, which features twin high performance 130mm bass drivers plus a centrally mounted 25mm dome tweeter in each cabinet. With a power rating of 80 watts and a cabinet volume of just 21 litres, it should suit those who need a compact but potent set of main or surround sound speakers.

by ROB EVANS

Developed by South Australian firm *Australian Audio Consultants*, the Jaycar JV40 three-driver two-way system has no doubt been designed to satisfy the current trend towards small speaker systems that offer impressive performance, while maintaining a very modest frontal area thanks to a 'slimline' cabinet design.

By using this increasingly popular *narrow, tall and deep* aspect ratio for the enclosure, the designer can keep the internal volume at a respectable figure in order to optimise the system's low-frequency performance, and at the same time present a quite small frontal area to the listener. With proper tuning and the right drivers, the resulting system will tend to *sound* big but *look* small...

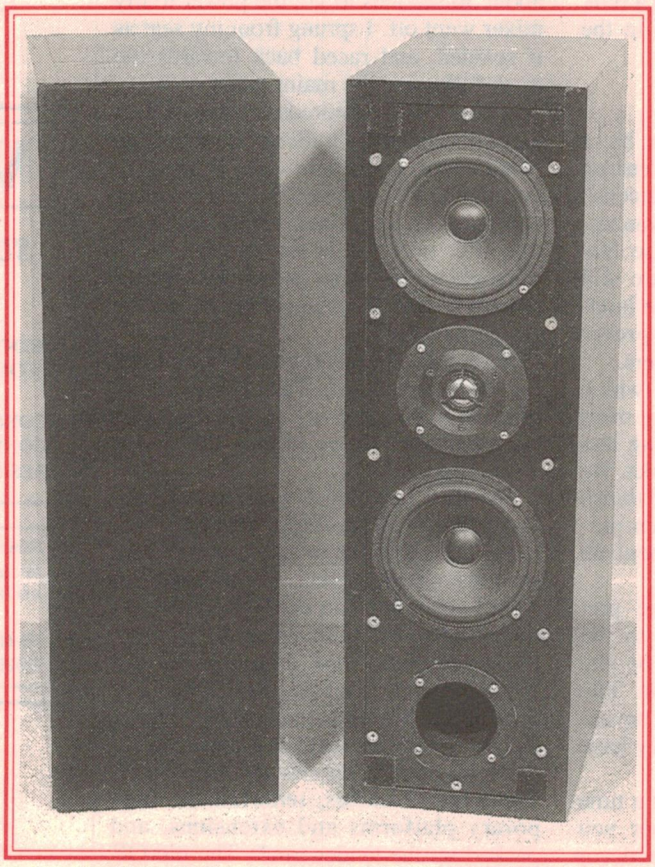
Since the enclosure has a very narrow front baffle board though, the concept really does depend upon the availability of a small diameter bass driver that offers a high performance, and in particular a good low frequency response — an attribute that's difficult to achieve in small bass drivers. In the case of the JV40, the designer has addressed this part of the equation by using *two* of Vifa's P13WG 130mm woofers, which have a respectable free-air resonance of 60Hz and a rated power handling of 40 watts.

As we've come to expect from this respected Danish speaker manufacturer, the Vifa P13WG is quite a refined little drive unit. With a 'mineral-filled' cone providing an effective piston area of around 100mm, it uses a cast magnesium alloy basket supporting a 240-gram magnet assembly, plus a generous 25mm voice coil working around a vented pole piece. And with a Qts (total Q) rating of 0.48 plus a Vas (equivalent air mass) figure of 10 litres, the P13WG is well suited to relatively small vented enclosures such as that used for the JV40.

The high end of the spectrum is handled by a Vifa 6-ohm D25AG 25mm dome tweeter which features magnetic fluid damping, a double chamber loading system and significantly, an aluminium coated diaphragm. We suspect that this latter feature plays a major part in the tweeter's very extended high-frequency response, which is rated as up to 35kHz. And this indeed appears to be the case in practice, since during our lab testing we noted that the D25AG was still producing its full output level at around 30kHz.

In a configuration that's becoming quite common, where two bass drivers are used in a slimline box, the designer has positioned the tweeter midway between the bass units — as you can see from the associated photo. While this moves the treble unit away from the top of the enclosure where it's more likely to be at ear level, this arrangement apparently improves both the linearity and phase response of the system around the crossover region. As the distance — and therefore the phase change — between the tweeter and each bass driver is then the same, this certainly seems like a more sensible approach than a traditional 'tweeter- woofer-woofer' configuration.

The enclosure itself has an internal volume of around 21 litres and external dimensions of 600 x 182 x 300mm (H x W x D), and according to our tests is tuned to about 55Hz by the front-mounted port tube. This is positioned just beneath the lower bass driver as you can see, and is made from a 105mm length of 72mm plas-



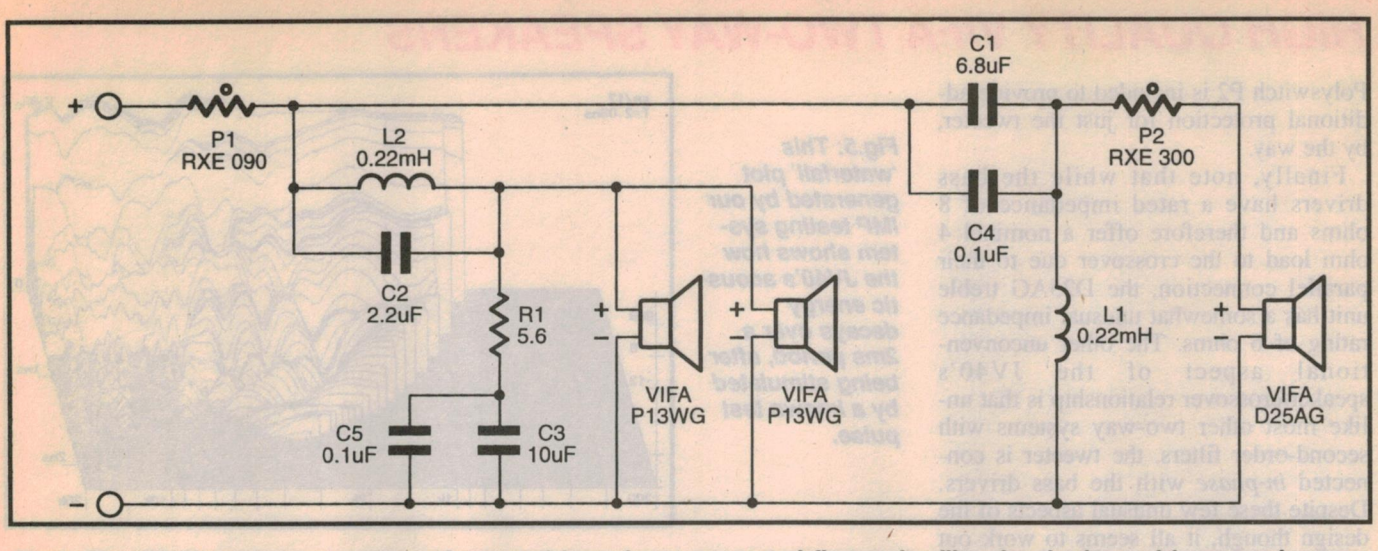


Fig.1: The JV40's crossover uses a phase and impedance corrected first order filter for the bass drivers, and a more conventional second order circuit for the tweeter. Note the polyswitch protection devices, P1 and P2.

tic tube that has a moulded mounting flange for a neat final appearance.

Crossover, protection

Of course, the act the placing a number of high quality drivers in a correctly tuned enclosure is only part of the objective when developing a high performance speaker system, and the final results will directly reflect on the quality of the crossover and how well it has been optimised for the speaker/enclosure setup. We suspect that there are a surprisingly large number of potentially good speaker systems on the market that have been badly let down in this regard...

Fortunately though, the JV40 designers appear to have taken considerable effort to extract the best possible performance from the Vifa drivers by paying a great deal of attention to both the quality of components used in the crossover, and importantly, the interactive relationship between the filter stages and the drivers. In the crossover circuit as shown in Fig.1, inductors L1 and L2 are of the air-cored type to avoid saturation at high power levels, and all capacitors have a working voltage rating of 100V or more to prevent failure when handling large signal transients.

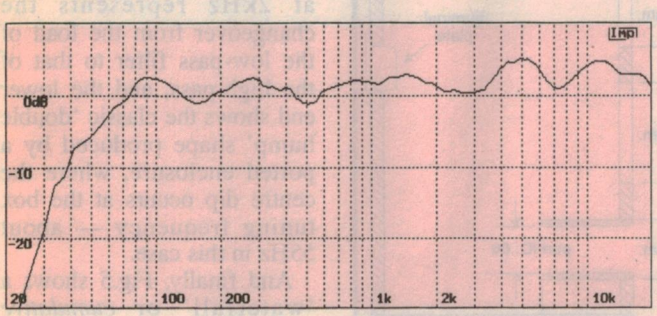
The crossover is basically a second-order Linkwitz-Riley type, and when connected to the drivers achieves a 12dB/octave rolloff slope with a nominal crossover frequency of 3kHz.

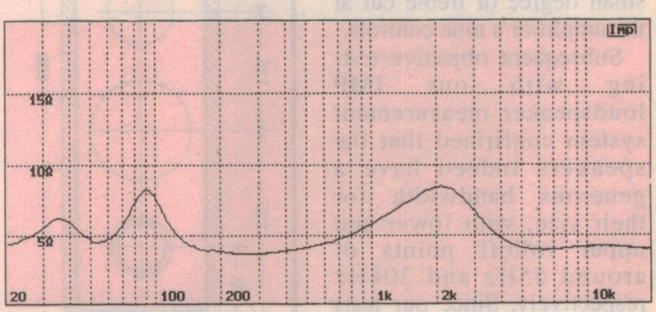
Referring to the schematic in Fig.1, you can see that the drive signal is first passed through polyswitch (P1) at the positive input which acts as overall protection for the system, and then on to both the high- and low-pass filter stages.

Inductor L2 forms the main element in the filter for the two bass drivers, and while this provides an essential rolloff of only around 6dB/octave, the bass drivers' natural high-frequency rolloff — their inherent low-pass filter, if you like — combines to produce an overall slope of about 12dB/octave. According to the design literature, C2 is then used to alter the phase response in the critical crossover part of the frequency range.

Other than that, R1 and C3 combine to form a Zobel network to compensate for the bass drivers' rising impedance at the crossover frequency, while the 0.1uF capacitor C5 is used to bypass C3 (a non-polarised electrolytic) at high frequencies. While it's difficult to ascertain the practical value of this additional shunt capacitor, it's safe to say that it certainly can't do any harm...

The high-pass filter section used to drive the D25AG tweeter is a more conventional second-order arrangement based on C1 and L1, and again, has its non-polarised electrolytic (C1) bypassed by a 0.1uF polyester capacitor, C4.





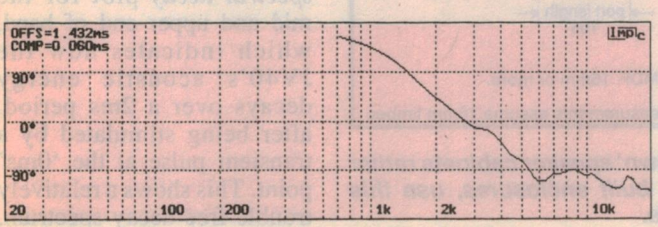


Fig.2 (top left): The measured frequency response of the system in our test room, with the speakers positioned well away from the walls and floor. Fig.3 (lower left): The mid and high frequency phase response plot shows a smooth transition, except for a few minor aberrations at the higher end. Fig.4 (right): The JV40's measured electrical impedance. As you can see, it shows a minimum impedance of around four ohms, and the low end has the standard 'double hump' shape of a vented enclosure.

Polyswitch P2 is included to provide additional protection for just the tweeter, by the way.

Finally, note that while the bass drivers have a rated impedance of 8 ohms and therefore offer a nominal 4 ohm load to the crossover due to their parallel connection, the D25AG treble unit has a somewhat unusual impedance rating of 6 ohms. The other unconventional aspect of the JV40's speaker/crossover relationship is that unlike most other two-way systems with second-order filters, the tweeter is connected *in-phase* with the bass drivers. Despite these few unusual aspects of the design though, it all seems to work out rather well — as you will see...

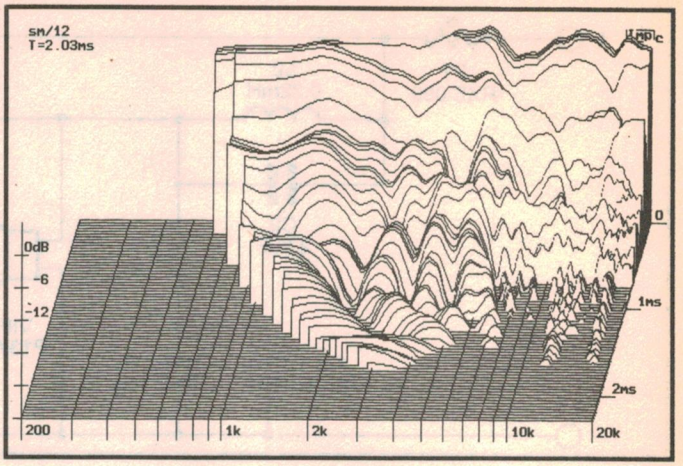


Fig.5: This 'waterfall' plot generated by our IMP testing system shows how the JV40's acoustic energy decays over a 2ms period, after being stimulated by a known test pulse.

On test

Our initial listening tests showed that the JV40's did indeed deliver an audio performance that seemed quite out of proportion to their modest size. Thanks to their generous power handling capability and the small front baffle dimensions of the slimline style of cabinet, you could easily imagine that a substantial subwoofer was augmenting the bass response, or you were in fact listening to a much larger set of speakers. Clearly, in this respect the designers have been quite successful.

Besides the impressive bandwidth and power handling ability of the JV40's, we also noted that the overall sound was commendably balanced — with a quite smooth midrange area and a very extended, if not a trifle 'edgy' treble response. This latter effect was fairly easy to contain by applying a small degree of treble cut at the amplifier's tone controls.

Subsequent objective testing with our IMP loudspeaker measurement system confirmed that the speakers indeed have a generous bandwidth for their size, with lower and upper rolloff points of around 55Hz and 30kHz respectively. Since our tests were performed with the JV40s positioned well above the floor and away from the walls by the way, we would expect the lower cutoff figure to improve when they are installed in a typical domestic environment.

In practice, the nearby wall/floor surfaces tend to assist the low frequency coupling between the speakers and the room, thereby enhancing their low end response.

As you can see from IMP's overall frequency response plot shown in Fig.2, the response curve for the JV40 is quite smooth in the low and critical midrange area but has a couple of noticeable peaks in the upper band.

While the moderate peaks at both 5kHz and 12kHz probably explain the speaker's slightly aggressive treble characteristics, the actual cause of the anomalies could only really be determined through extensive testing. From past experience however, we would guess that the bump at 12kHz is a resonant by-product of the D25AG tweeter's aluminium alloy diaphragm, and the 5kHz crest may be due to the sum of coincident and in-phase energy from the bass and treble drivers at that point.

As you can see from the phase plot for the higher frequencies presented in Fig.3, the change is quite smooth in the important midrange area up to about 5kHz, but makes a relatively abrupt transition at around 6kHz.

As it happens, this latter deviation may in fact support our impression that the JV40's exhibit an adverse but modest degree of phase addition and cancellation in the upper-midrange/treble area.

Fig.4 shows the electrical impedance of the JV40 over the full audio range, and as you can see it's quite typical for a nominally 4 ohm two-way system using a vented cabinet. Here, the broad peak at 2kHz represents the changeover from the load of the low-pass filter to that of the high-pass, and the lower end shows the classic 'double hump' shape produced by a ported enclosure, where the centre dip occurs at the box tuning frequency — about 55Hz in this case.

And finally, Fig.5 shows a 'waterfall' or *cumulative spectral decay* plot for the mid and upper end of band, which indicates how the JV40's acoustic energy decays over a 2ms period, after being stimulated by a transient pulse at the '0ms' point. This shows a relatively trouble-free decay spectrum,

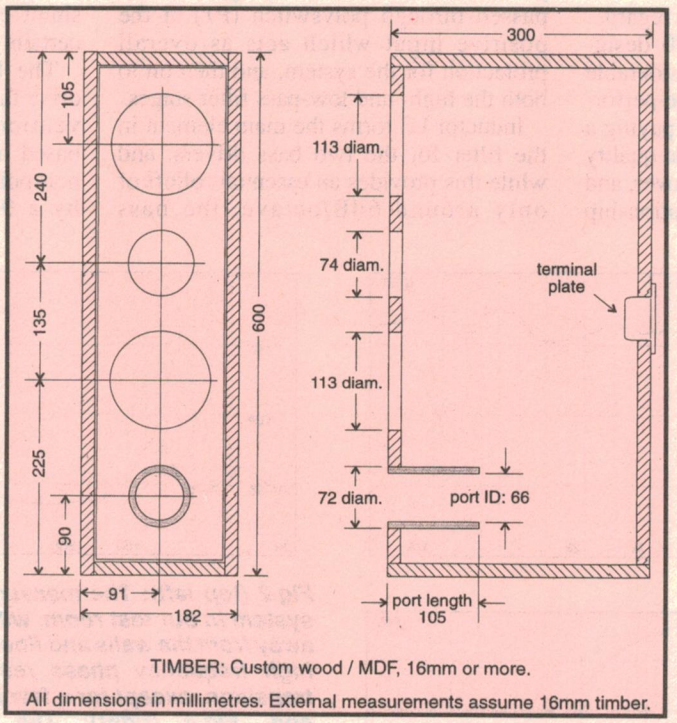


Fig.6: If you prefer to 'roll your own' speaker cabinets rather than purchase Jaycar's ready built enclosures, use this diagram as a construction guide.

with just a few frequencies in the mid range area 'holding on' for a short period.

So all in all, with the exception of a couple of fairly minor aberrations, the JV40s came up well in both our listening and lab tests. We were particularly impressed with their wide bandwidth, the ability to handle high power levels without fuss, plus of course, the level of performance that the designers have extracted from the compact slimline enclosures.

The JV40 kit

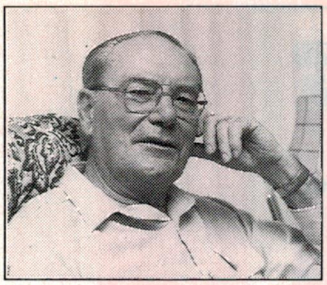
Jaycar have taken the very flexible approach of offering the JV40's — and the other models in their new Vifa-based range — in a modular kit form, where the speakers (plus peripherals) and the enclosures are available as separate kit items. If you have the woodworking skills and suitable equipment then, you can simply purchase the 'speaker' kit from Jaycar and construct your own enclosures. As a guide to their assembly, we've included a basic drawing of the enclosure construction showing all of the relevant dimensions — see Fig.6.

Alternatively, you can buy a set of Jaycar's pre-assembled enclosures which are finished in 'blackwood' veneer, and include front grille assemblies with matching black grillcloth and Velcro-type fasteners. The cabinets are priced at $239 per pair, and are finished to a point where the drivers and support components can be immediately installed.

The actual driver kit includes four P13WG woofers, two D25AG tweeters, two terminal plate-mounted crossovers with polyswitch protection devices, innerbond damping material and all the necessary mounting screws. It's priced at $489 and includes all of the parts you need to construct a pair of JV40s, with the exception of the cabinets of course.

And by the way, if you are not in a position to construct your own enclosures and have elected to purchase both the speaker kit and cabinets from Jaycar, they are offering a reduced price of $699 for the complete kit setup. Normally, the two kit 'modules' would come to a total of $728, so this offers a modest but useful saving.

At a nominal price of $699 then, we feel that the JV40's represent very good value for money when compared to commercial speakers offering a similar level of performance. The kit is extremely quick and easy to assemble, and the final result delivers an impressive sound from a surprisingly small package. Kits for the JV40 can be found at Jaycar Electronics stores around Australia. ❖



When I Think Back...

by Neville Williams

The Car Radio Industry: Traps for the unwary, but a career for Vic Humphrey!

Old-style car radios are not dead; they can still be retro-fitted logically into cars of comparable vintage. But whereas the physical attributes of an older car may respond predictably to tender loving care, vintage car radios in particular can be pesky gadgets that may or may not fit readily — or work well — in restored vehicles. Having been a specialist in the field, Vic Humphrey's observations about the industry should be of interest to readers who like to listen while they drive.

If what follows betrays my own personal reservations about old, vibrator powered car radios, so be it!

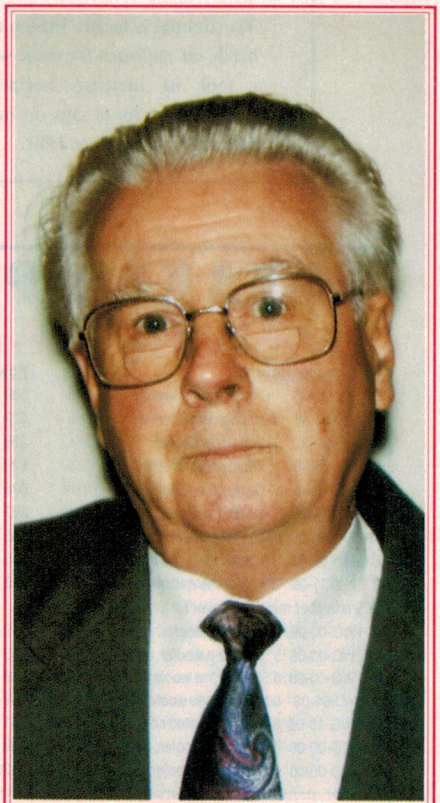
Over the years, I have derived considerable satisfaction from assembling all manner of domestic receivers, amplifiers and associated electronic what-nots. On a shelf or occasional table, or occupying pride of place against a feature wall, they have rested comfortably in the situation allotted them — a source of on-going satisfaction and an integral part of the domestic scene.

But unlike an ordinary home, yesterday's cars lacked a convenient, uniform environment for an on-board radio receiver. Installing them could be a real chore — especially in the days when the HT supply involved the use of a genemotor!

In a car, the driver had to be provided with a steering column, gear shift and handbrake, foot pedals, switches, buttons and instruments, all within easy reach.

By the time the planners had installed facilities for the passengers, their baggage and their needs, the space available for a radio was 'whatever happened to be left over' — not much, in a small car, and generally of indeterminate shape and position!

Likely as not, a 'general-purpose' car radio could end up as a chunky steel box crammed with components, and of dimensions such that it could hopefully be mounted somewhere. Or it might comprise two such boxes, and/or a separate loudspeaker.



Vic Humphrey — a recent photo. He spent the latter years of his career developing installation kits and literature to simplify the procedure for particular receivers and cars.

If the available space was inaccessible — horrible thought — the controls might even be grouped on an outrigger panel, connected to the box by Bowden cables!

There was also a potential 'hash' problem to bear in mind, arising in part from the receiver's inbuilt vibrator HT supply, and in part from the vehicle's own ignition system. Both had to be sufficiently suppressed for the receiver to log distant stations, on its pitifully small on-board antenna!

Installation was essentially a young man's work — lying awkwardly on one's back, legs draped over the front seat squab and head against the clutch and steering column, while he/you grappled with brackets and cables up under the dash. Nor could he/you forget that the whole procedure had to be reversed, if the contents of the steel box(es) ever needed to be accessed for repair or adjustment. Yuck!

Our first car radio

As it happens, I was a much younger man myself, when we tackled the development and installation of the first *Radio & Hobbies* 'Karset' for home construction (published in the May 1949 issue). At the time, I had been emboldened by detailed work on vibrators presented at the IRE World Radio Convention (Sydney, 1938) by the late Graham Hall; also an expression of interest by another friend, the late Doug Ferguson, to develop and market a line of vibrator transformers.

Having contemplated the disincentives and possible complaints from disillusioned readers, I was in two minds whether to publish the article at all. For-

tunately I/we opted for what we regarded as 'a step in the dark', discovering in the process that: (1) *R&H* readers of the day were keen to tackle a do-it- yourself car radio; and (2) they were not daunted by the possible problems outlined above.

Faced with this surprising reaction and with no back copies left of the original article, we even featured a second, updated version in the March 1952 issue — 'The 1952 Karset', developed by staff member (the late) Raymond Howe. Pictured here as Fig.2, it reflects much of the thinking that characterised general-purpose car radios of the period.

While we conceded that American style vehicles might accommodate a single unit receiver, such was not true of the commonly smaller British and continental models. This being the case, both *R&H* Karsets had occupied three smaller boxes: (1) the receiver proper, (2) the vibrator power supply and (3) the loudspeaker.

Hopefully, the receiver could be mounted by brackets to the under-lip of the facia panel, so placed as not to tangle with the gear shift stick or the shins of a possible centre-front passenger. In a really small car it might even be mounted in, or in place of, the glove box. The power supply and loudspeaker box (again hopefully) could be bolted elsewhere to the engine bulkhead.

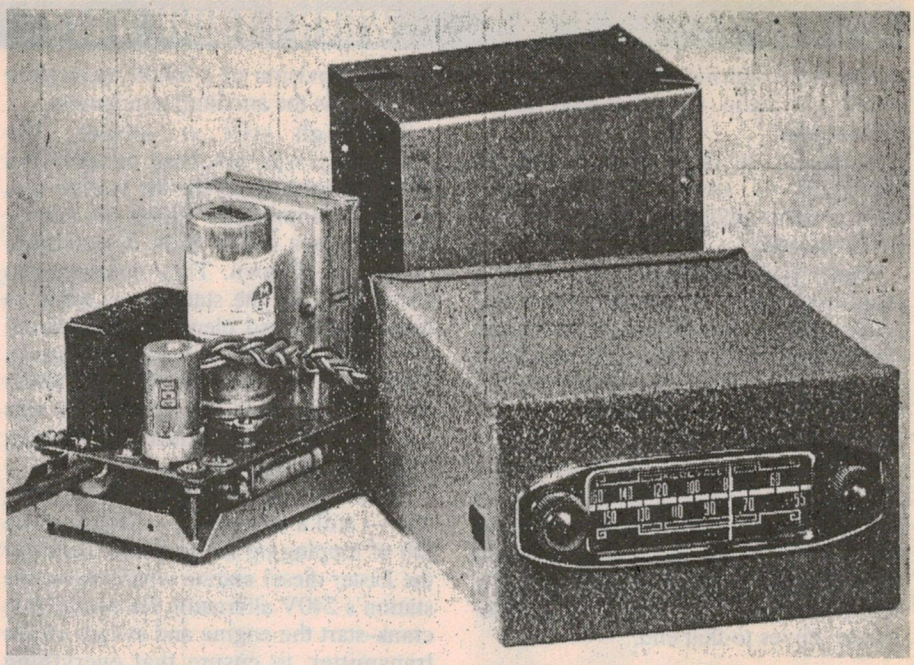
Conversely, for a large vehicle, the dimensions were such that the power unit could be attached to the rear of the receiver, to constitute in effect a single large box, with knobs and dial still accessible.

Of the 1952 Karset we claimed that, if constructed exactly as per the published diagram, there should be no problem with vibrator hash; while a properly installed telescopic antenna and the possible use of suppression measures should cope with ignition noise.

So said, the do-it-yourself exercise didn't seem quite as off- putting as it might first have appeared, and in the knowledge that members of the magazine staff had been through the exercise in detail on readers' behalf. Even so, as I suggested earlier, there was a lot more to the exercise than building a mains powered receiver, attaching a two-metre wire antenna, and perching it on the mantel shelf!

Car radio enthusiast

But how did I get started on this theme in the first place? Answer: because a long-time reader called Victor



The R&H 'Karset', as pictured in the March 1952 issue. It was assumed that the receiver could be supported under and behind the dash, with the controls accessible to the driver and/or the front seat passenger.

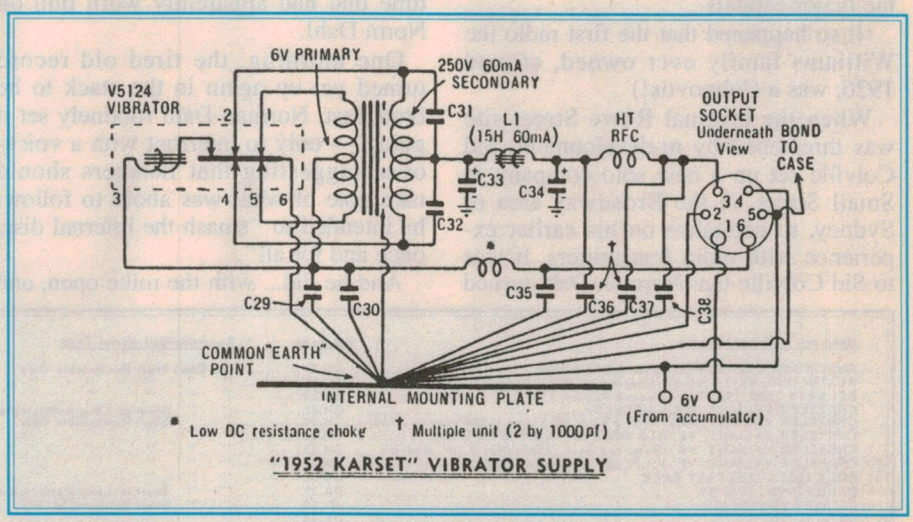
Humphrey remarked to me that his prime interest in electronics had been in car radios — "not just the later models using transistors, but the ones where we did things the hard way, using valves and vibrators"! He even enthused about how expert he and his contemporaries had become in reclaiming faulty vibrators!

"Align and re-dress the contacts until no sparking was visible in the dark, and they'd work like a bought one!"

I was intrigued, to say the least. How could an old-time wireless enthusiast develop such an unusual partiality?

My first contact with Vic Humphrey was a fax/letter passed on to me via the *EA* office, suggesting that the B&W Kelvinator TV receiver mentioned in this column for April 1995 was probably a re-badged HMV model F4. As a former HMV/EMI staffer, he was well aware of the re-badging arrangement between HMV and Kelvinator — 'TVs for fridges'.

Vic's address put him only a few blocks away from me and, contacted by phone, he said that he had never been directly concerned with television; his specialty having been in the car radio market. Although officially retired at age 74, he still dabbled in the field at in-



Reprinted from the March 1952 issue, this diagram emphasises the use of single point earthing within the vibrator power supply — a measure intended to limit the penetration of 'noisy' earth currents into the signal path.

dustry level and may potentially be the oldest car radio specialist still active in Australia!

A couple of days later, he related his story — over tea and scones, and a microphone feeding onto a C-90 cassette!

Victor Kyle Humphrey was born in Auckland, NZ in September 1920, but spent his boyhood in Ayr, Northern Queensland. There, while still at school, he was confronted by family wireless/radio with the establishment of the local radio station 4AY.

The moving spirit behind the venture was a Sydney amateur by the name of Norman Dahl. On a visit to Ayr in the early 1930s, Dahl became convinced that Ayr was a promising site to establish a local radio station and he duly initiated moves to that end.

Oral history: Sid Colville

As it happened, Norman Dahl was a friend of the pioneer radio dealer Sid Colville, who was featured in these columns for March 1989. Vic Humphrey's story sheds further light on Colville's career.

Briefly, Sid Colville had been active in radio since 1912 and had formed the Queensland branch of the WIA (Wireless Institute of Australia) installing an amateur radio transmitter on the premises. Later, with partner A.L. Moore, he had set up Colville-Moore Wireless Supplies Ltd in Rowe Street, Sydney (adjacent to Martin Place), to manufacture 'Colmovox' receivers; this was during the 1920s, following the establishment of public broadcasting in the major capitals.

(It so happened that the first radio the Williams family ever owned, around 1926, was a Colmovox!)

When the original Rowe Street site was threatened by re-development, Sid Colville set up a new solo company in Smail Street, in the Broadway area of Sydney, to capitalise on his earlier experience with radio transmitters. It was to Sid Colville that Norman Dahl turned for the provision of a 500W transmitter at Ayr, plus the ancilliary equipment.

Although still at school, Vic Humphrey was involved because the building earmarked for the station was the large homestead which his family rented, on a sugar farm about three miles out of town. They continued to live there until the station was ready to open, and he had plenty of opportunity to fraternise with (or pester?) Norman Dahl, Sid Colville and William (Bill) Maguire, another old-timer who was Colville's Chief Engineer and Factory Supervisor at the time.

When the station commenced service, Vic — still a schoolboy — inherited the job of topping up the fuel tank daily for the Lister diesel engine which drove the station's 240V alternator. He would then crank-start the engine and switch on the transmitter, to ensure that everything seemed to be working.

A 'smashing' time

To alert the listeners that the station was preparing for its official 7am start-up, he would put discs on the turntables, set the first one going and then hurry around to make sure that Mr Dahl was ready to host the official transmission. Miles from anywhere, it didn't matter whether Mr Dahl was fully dressed for the occasion or still in his dressing gown — as was often the case!

At the time, Ayr listeners were very partial to yodelling records, and one that often made it on to the turntables was Tex Morton's 'Mother, the Queen of my Heart'. Frequently requested by listeners for 'Mum's birthday', it was a tune that had apparently worn thin on Norm Dahl.

One morning, the tired old record turned yet up again in the stack to be broadcast. Norman Dahl routinely set it going — only to interrupt with a voice-over suggesting that listeners should take note of what was about to follow: he intended to "smash the infernal disc, once and for all".

And he did... with the mike open, and a crash that resounded far and wide on-air around Ayr!

Incidentally, Vic says that he received the grand sum of four shillings per week for odd jobs around the station — plus keeping the Company car washed and polished! When he left school, he was upgraded to cadet engineer and spent several more pleasurable months on and off the job.

His off-the-job duties included accompanying the boss, when Norm Dahl needed a change away from the studio. With a relief announcer 'holding the fort', they would climb into Norm's outboard runabout and enjoy a fishing trip in the mouth of the nearby Burdekin river!

When Norman Dahl died shortly afterwards, the station was taken over by his son Edward (Ted). But Vic's own days at Ayr were also numbered — for another reason.

Anxious about his future career, Vic's grandmother undertook to assist him migrate to Sydney, with a view to gaining more meaningful experience and training in radio — his prime interest. So it was that he found himself working for Sid Colville in Smail Street, Sydney in 1938, as well as being enrolled in a part-time study course at AWA's Marconi School.

Factory 'gopher'

It was a memorable interlude for young Vic, which will strike a chord amongst other old timers who started work on the bottom rung of a factory ladder. He still remembers buying a Sargent's pie and a buttered roll each day for engineer Bill Maguire's lunch, and recalls that Bill later joined AWA where he became involved in a wartime development "which he preferred not to discuss, for obvious reasons".

Another young engineer on Sid Colville's staff at the time was Ron Mitchell, who subsequently joined 2UW as night engineer, and later the Navy at the outbreak of war. Returning to 2UW at the end of the war, he decided that

Make and Model of Vehicle	Kit Type	Recommended Aerial Type	Rear Speaker Kit
AUSTIN 1800 1965/68 WOODGRAIN DASH TRIM	AU.21	Top Cowl Short Retractable Only	RS.18
AUSTIN 1800, MK11 1968-69 (Models with Small Central Glove Box)	AU.31	" " " " "	RS.18
BELLETT 1500, 1966/69 (Released August, 1966)	BE.30	" " " " "	RS.18
CHRYSLER VALIANT, R & S MODELS	CH.21	" " Short or Long Retractable	RS.13
CHRYSLER VALIANT, AP5, AP6, PV8 & VC Series (1964 to early 1968)	CH.20	" " Short Retractable Only	RS.13
CHRYSLER VALIANT 'VE' ALL MODELS (Released Early 1968)	CH.22	" " " " "	RS.13
CHRYSLER VALIANT 'VF' (Released April, 1969) (Not V.I.P. Models)	CH.23	" " " " "	RS.13
* CHRYSLER VALIANT 'VF'-V.I.P. (Released April, 1969)	CH.24	" " " " "	RS.13
COLT 1000 & 1100 FAST BACK	CO.30	" " " " "	RS.18
DAIMLER V8 - 1963/69	DA.31	" " Short or Long Retractable	RS.17
DAIMLER SOVEREIGN	JA .20	" " Short Retractable Only	RS.18
DATSUN 1600	DA.30	" " " " "	RS.18
DATSUN 1600 MK11	DA.32	" " Short or Long Retractable	RS.18
FIAT 124 - SEDAN & STATION SEDAN	FI .32	" " Short Retractable Only	RS.18
FIAT 125	FI .17	" " " " "	RS.18
FIAT 124 COUPE	FI .18	" " " " "	RS.18
FORD FALCON, XL, XK & XP	FO.23	" " " " "	RS.13

Extracted from an EMI Product Digest of November 1969, written by Vic Humphrey, this list gives a sampling of the many installation kits, aerials and speaker kits that were needed to adapt the three car radio models to each kind of vehicle.

living in suburban Roseville and working night shift in the city was no longer to his liking. So he bought a pineapple farm at Nambour, where he could spend his days with shorts, sunhat and a tractor!

As for Sid Colville, he was also a licenced pilot and spent time flying with 'Smithy', while also experimenting with airborne two-way radio. A highlight for Vic Humphrey was when he was offered a flight out of Mascot on a RFDS (Flying Doctor) de Haviland Dragon, piloted by a man called 'Hughie'. Vic's job was to squat on a patient stretcher and lower a weighted copper wire antenna from a large fishing reel through a hole in the fuselage floor — reeling it in again prior to landing.

During this period, he said, Sid Colville was manufacturing small two-way radio equipment, genemotor powered, for the Flying Doctor, Forestry Commission, etc.

Sid found the going tough during the war and moved into smaller premises in 'Australia House' opposite Wynyard Park, where he continued to specialise in two-way radio equipment. Vic recalls that Sid Colville passed away at Glenbrook, NSW, in his 70's.

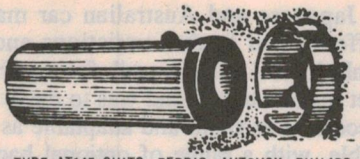
In the meantime Vic Humphrey himself had a chequered career, spending two years full-time at the Marconi School to complete a broadcast operator's course; held a part-time position with 2GB as a cadet engineer; worked as a service technician for Marcus Clarks and Nicholsons; and for two years (1943-5) as a final tester for Breville Radio. There, he was involved with landmine detectors and other equipment for the armed forces.

First encounter

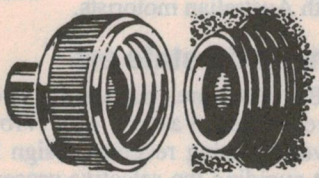
While all this seemed to foreshadow a broadly based involvement with radio technology, Vic's next move led to his 50-year career in car radio. It came about because, while employed by Nicholsons, he had encountered another technician called A.W. (Wally) Barrs, who had worked for Thom and Smith (Tasma).

At the time, Tasma had become involved in producing car radios and had done a deal with the Ford Motor Company, out of which came the Tasma-Ford car receiver — with a fortuitous blending of the two trade marks. Keen to do the right thing, Fred Thom had opened a depot in East Sydney, trading as 'Tasma Car Radio Sales & Service', managed by the aforesaid Wally Barrs.

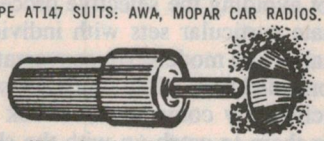
Unfortunately, due largely to wartime conditions, the depot proved more of a hindrance than a help to Tasma and Fred Thom decided to close it down. Wally Barrs, on the other hand, felt that the venture had a future and decided to take over and operate it as his own company: 'A.W. Barrs Car Radio'.



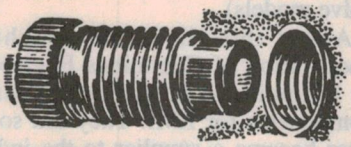
TYPE AT145 SUITS: FERRIS, AUTOVOX, PHILIPS, PYE, WALBAR, TELECOND, ROADSTAR CAR RADIOS.



TYPE AT147 SUITS: AWA, MOPAR CAR RADIOS.

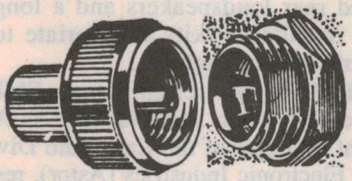


TYPE AT151 SUITS: ASTOR, AIRCHIEF, FORD, MOPAR, BMC, AWA, PHILIPS CAR RADIOS. AWA PORTABLE RADIOS.

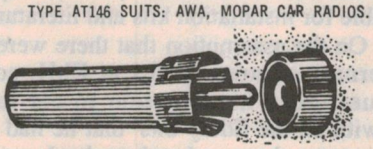


TYPE AT150 SUITS: ASTOR, AIRCHIEF, FORD, MOPAR, BMC CAR RADIOS.

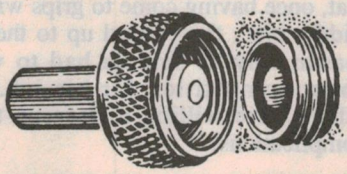
TYPE AT152 SUITS: HMV, PLAYMATE AND ALL JAPANESE CAR RADIOS. HMV, KRIESLER PORTABLES.



TYPE AT146 SUITS: AWA, MOPAR CAR RADIOS.



TYPE AT148 SUITS: AWA, FORD, WALBAR, AUSTRAL, TELETONE CAR RADIOS. STROMBERG CARLSON PORTABLE.



TYPE AT149 SUITS: ASTOR, AIRCHIEF, FORD, ECLIPSE, MOPAR, BMC CAR RADIOS.

It helps to have the right connectors on hand: a range of options advertised by Wally Barrs in Mingay's Electrical Weekly, October 11, 1963.

True to title, and with the support of Jack Purcell, Wally acted as an agent for Tasma, AWA and EMI — the last named handling British-made car radios intended mainly for Austin/Morris/Wolseley vehicles. For extra revenue, Barrs fitted police and other service vehicles with two-way radio and picked up a fair number of private orders for large, custom-built radio/amplifier systems for prosperous customers.

In 1945, Vic Humphrey was offered a position in Wally Barrs' company as a technician — a tantalising decision for a young man who, by then, had inherited responsibilities as the family breadwinner.

On finally accepting the offer, he found himself in the world of car radio — one where the receivers were often large and heavy and incompatible with the vehicle in which they had to be mounted.

Installation problems

Some even required the installation of customised angle iron mounting brackets; others relied on tenuous mechanical remote tuning via Bowden cables. Still others involved an audio/power unit in the engine compartment, with a 25mm (1") hole through the firewall for a multi-shielded connecting cable. It was a cruel environment for old-style electronic equipment, calling in some cases for a canvas cover by way of added protection.

It didn't take long for Vic Humphrey to appreciate the urgent need for manufacturers generally to 'tailor' both vehicles and radios to complement each other.

Back in the 1950s, however, the only off-the-shelf installation hardware comprised a few bits and pieces to suit a very limited range of vehicles and receivers, usually supplied by the receiver manufacturers. The Tasma-Ford arrangement was a rare example.

Ahead lay the job of developing and documenting the routines for fitting other receivers to other cars. The points to take note of: polarity, position, connectors, cables, brackets, facia trim plates, fixing screws, etc. Such preparedness should reduce materially the frustration, tedium and wasted time of anyone tackling installations on an otherwise random, 'one-off' basis.

Vic must certainly have found the en-

vironment challenging, and I gather that he burned a deal of 'midnight oil' compiling information about cars and radios, and sketching bits of hardware that would facilitate and speed installation. It was to become a way of life!

Joining the staff as a technician, he was progressively promoted to service supervisor and administrator. In 1952 he moved to Brisbane, with a commmission to found and manage a branch there. But largely for family reasons, he returned to Sydney where he became part of the management team, responsible for a new wholesale division.

EMI/HMV Car Radio

In 1953, Vic resigned from the Wally Barrs Group and joined EMI as field engineer responsible for car radio products, including the development of installation kits and literature. From there he moved to Manager of the Car Radio Division, becoming involved in sales. 1957 saw him promoted to National Sales Manager for EMI's Car Radio Division — a position that he held until 1969.

It was while Vic was at EMI that he saw the Company's expansion into television, and observed their arrangement with Kelvinator and its re-badging of EMI/HMV B&W TV receivers. He did a course in TV with the Australian Radio College, but while paying spontaneous tribute to the late Rex Lackey as a lecturer, decided to stay with car radio as a career.

Vic's on-going interest in documentation was evidenced in a conference on car radio, organised by the Sydney Division of the IRE in August 1963. During the preceeding years, he said, a lot of effort had been directed into the development of mechanical push-button tuning systems, with many of the sets imprecise and difficult to install.

Vic pointed out that English cars were at the time gravitating towards a space in the facia of 7x7x2 inches, which was restricting but at least a figure for receiver manufacturers to aspire to. Continental cars had tended to follow the English lead, but often required appropriate facia trims to ensure a professional finish.

American cars provided more space, but used variously styled trims meant to favour the set-maker contracted by the car manufacturer; they also served, quite deliberately, to disadvantage rival set makers — thereby compounding installation problems.

Japanese and Australian car makers offered still further variations and the only logical way, overall, for Australian set makers to respond was to make their receivers as small and adaptable as possible, with a range of optional back-up installation kits to suit vehicles popular with Australian motorists.

The solid state era

By that time, transistors had taken over from valves and vibrators, revolutionising receiver design but still not avoiding the selective procedures to mate particular sets with individual car makes and models. (In conversation, Vic conceded that, while transistor sets were technically convenient, it took a while for them to catch up with the sheer station-to-station performance of the better valve models).

About this time, Vic sought the cooperation of Cummings Engineering in Balmain, to fabricate installation components for EMI. They did so, and later became a supplier to the industry of mounting hardware, trim plates, loudspeaker boxes, etc.

A typical EMI/HMV product leaflet dated 1969 lists three current transistor receivers, 70-odd cars to which they might conceivably need to be fitted, 10-odd antenna options, front and rear loudspeakers and a long list of installation kits appropriate to the various combinations.

In 1970, Vic resigned from EMI and accepted a job in Melbourne as Assistant Manager of the Car Radio Division of Electronic Industries (Astor), responsible for installation kits and literature.

On the assumption that there were alternative career paths at EMI, some questioned his devotion to car radio 'with all the fiddly bits' that he had had to worry about — brackets, leads, antennas and procedures. Vic's answer was that, once having come to grips with the 'fiddly bits', they added up to the very reason why he seldom had to worry about competition for his job. Few others were willing to face up to the complications!

To AWA and Sydney

Unfortunately, the move to Melbourne also proved to have its drawbacks at a family level and, within a couple of years, he transferred to AWA as their Victorian Car Radio Sales Manager, with an oblique involvement in automotive air conditioning.

More to the point, however, the move provided an option of returning to Sydney as Assistant Commonwealth Manager (Car Radio) and Account Executive for Chrysler.

Amongst Vic's papers is a copy of an unusual personal letter from Ron Harris, a Director of EIL to John Bailey, AGM of AWA, commenting on the move. The final par reads:

I can only say we all believe you have acquired an excellent executive and we are sorry to see him leave. He has open invitation to return, so you had better be kind to him!

In fact, Vic completed the career circle in 1975 by rejoining A.W. Barrs as Merchandising Manager. When it later became the Walbar Division of Philips Car Radio (Rhodes, NSW), Vic became Manager, answerable to the GM in Melbourne. His job: responsibility for the manufacture of car radio products and accessories — including the 'fiddly bits' that he'd first envisaged at Wally Barrs in the forties!

But, come 1980, he had just celebrated his 60th birthday and how to manage his affairs in retirement was high on the agenda. That's when he formed Humphrey's Auto Sound Accessories Pty Ltd, and set up a small factory at Gladesville, NSW. He kept right on devising and manufacturing car installation kits for companies such as Philips, AWA and Eurovox, along with 'OE' (original equipment) components which were supplied to car assemblers for inclusion in the basic vehicle, to ready it for radio installation.

For good measure, he also organised vacuum-forming facilities to make housings for extras such as loudspeakers and stereo cassette players, to special order.

One thing Vic did NOT get involved in was the provision of high power audio systems in road vehicles. To him, the idea of replacing the rear squab with baffled woofers is ludicrous — along with a super-power amplifier and a battery bank which needs to be charged overnight, so that the occupants can deafen themselves prematurely, without waiting for old age!

With the calendar now reminding him that it's year 1995, Vic no longer owns a factory and he no longer needs to 'go to work'. Instead, he lives quietly at home with his wife, Joan, remaining accessible in an advisory capacity to his industry associates of other days — enough to assert that he's still active in the game! ❖

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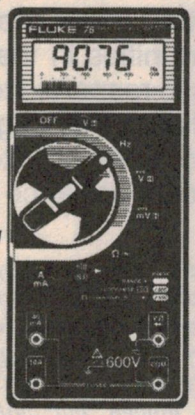

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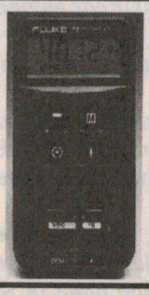

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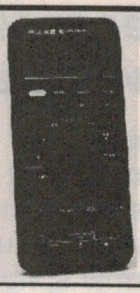

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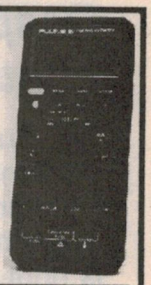

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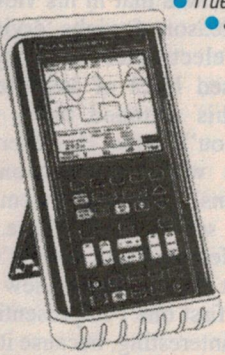

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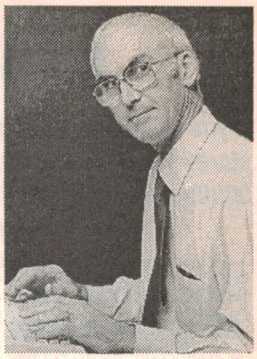

Responses to that letter in May, about problems in New Zealand's industry...

Do you remember that rather sobering letter I published here in the May issue, from Richard Williams of Pukekohe in New Zealand, about the diminishing job opportunities in that country's electronics industry? Well, there have been a number of letters and faxes in response to it — most of them from New Zealand, and only one actually agreeing with Mr Williams! Although the topic is right at the 'outer limits' of our normal sphere of discussion here, and drags us into the unfamiliar and risky territory of economics and politics, it's one that is of direct importance to many of our readers in both countries.

Perhaps you'll recall that one of the points made by our New Zealand contributor Richard Williams, in the May column, was that in his view one of the prime reasons for jobs 'drying up' in the local electronics industry, was the increased level of imported products. And this sounded fairly plausible, I think you'll agree. However many of the people who have responded to Mr Williams' letter don't seem to think so, and as some of them have also written from New Zealand, I feel it's only fair to present their points of view as well.

The first one I'm presenting is particularly interesting, because it comes from someone at the very top of the New Zealand electronics industry: Mr Angus Tait, the founder and current Managing Director of Tait Electronics, the well-known manufacturer and exporter of two-way radio equipment.

In recent years Tait Electronics seems to have been remarkably successful in both New Zealand and other countries, including Australia, with its products. This suggests that whatever problems might be occurring in other areas of the NZ electronics industry, they haven't been allowed to occur in Mr Tait's company — presumably because of the decisions made by Mr Tait and his team.

From this it seems likely that Mr Tait would have a pretty good handle on the situation, and that his comments would be well worth reading. Here, then, is what he has to say:

I simply cannot let the letter in your May column, from R. Williams of Pukekohe, pass without comment.

His letter is too long to comment blow by blow, so let me make some general observations. Firstly he does our country a disservice in the scene that he describes. He destroys his credibility in such statements as —

"Most technicians are paid less than the average wage."

"Most people if their car engine needs to be repaired, buy an imported engine from an importer and drop it in themselves."

"Crime rates are soaring out of control."

I don't know about life in Pukekohe, but they are simply not true of the wider NZ that I know.

I can speak with some knowledge of our electronics industry. I operate the largest manufacturing plant in NZ (and I think in Australasia), employing over 600 people and selling our communications products in about 80 countries — 85% of production exported.

The 'Good Old Days'?

Clearly R. Williams looks back wistfully at the 'good old days' of tariff walls, cost-plus manufacturing, second rate technology, import licences and the bureaucrats in full control. A fools' paradise in which we were persuaded, for a while, that we could isolate ourselves from the real world. The cold shower of reality came in time, just before we would have gone bust as a nation.

Sure it's been painful — exposure to the sun can be very painful after years under an umbrella. Yes, firms folded (and Government Departments) and people lost jobs. The real world is hard and not very forgiving, but it does not owe us a living and so we must make our way as best we can. To imagine that there is some nice fairy land alternative is just that.

While R Williams may describe the scene today in dismal terms, my view is totally out of phase with his. Yes, the old industry has been swept away — it couldn't stand on its feet without subsidies — hidden, but quite real, in the prices that the captive customers paid. We now have a new electronics industry, infinitely more able than the old, equipped for world class performance, offering career opportunities to well educated technicians and engineers. The old industry might have employed one or two design engineers per firm. We have an engineering group with 120 staff — such is the scale of effort needed to compete on world markets.

Niche opportunities

But this new industry finds its success in niche opportunities — my company in mobile communications equipment, others in a variety of professional equipment fields.

The concept of manufacturing domestic equipment from such a small economic base as NZ is unreal. Better by far to exploit the niches and import the domestic products — horses for courses. The process is uncomfortable for the old school, but look the facts in the eye: board level servicing in the field is inevitably a dying art. How can an SMD board be coped with anywhere else other than a dedicated service centre. Besides — how often do they fail?

The situation that exists here in NZ regarding imported products, new industries and changing patterns of employment is not unique. Protected economies are out, market forces are in.

It's a worldwide phenomenon. It has

some harsh dimensions, but also great rewards. The alternatives have been tried and discarded.

Thanks indeed for those comments, Mr Tait. They certainly provide plenty of food for thought, especially coming from someone as experienced as yourself in establishing a sound manufacturing firm with considerable success in exporting around the world. If anyone can lay claim to having achieved what Mr Williams said needed to be done, *you* can — I only wish we had a few more manufacturing entrepreneurs like yourself, here in Australia!

I think I can grasp many of the points you make, and there seem to be quite a few parallels with the Australian scene. I guess you're right in asserting that whether countries and their industries like it or not, ultimately the only way they can survive in the long term is by becoming a part of the 'real world' — harsh though this may be. No doubt you're also right in stating that none of us is 'owed a living', too.

Over here in Australia, prior to 1975, we too had an electronics industry protected by fairly high tariff walls. Like yours it had undoubtedly grown rather inefficient and not terribly competitive, and it was perhaps inevitable that sooner or later its protective 'hothouse' would have to be dismantled, so that the 'plants' inside could be encouraged (helped?) to cope with the real world outside.

Flourishing factories

I suppose many of us think back, though, and remember the many flourishing factories with their thousands of skilled employees, cranking out everything from transistors and ICs through radios, TV sets and hifi systems, all the way to military equipment and complete radio and TV broadcasting transmitters. And we also remember what happened to many — in fact most — of those factories and the jobs of their employees, when the tariff 'hothouse' was pulled down, overnight. They simply shrivelled up and died from exposure...

Perhaps if the hothouse had been dismanted slowly, with the doors left open for a while and then the panes removed one by one over a period, many of the 'plants' would have acclimatised and survived — and along with them, many worthwhile jobs.

I don't know if this is the sort of thing that has happened in New Zealand as well, but perhaps it is.

Many of us can probably agree that an industry that can't survive in the real world without heavy tariffs and subsidies isn't really healthy, and needs to be given suitable treatment — perhaps including some judicious 'pruning'. But there are surely good and bad ways of doing this, don't you think? At least in terms of their ramifications for the many people working in the industries concerned, and the degree of disruption to their lives.

Although Mr Tait's comment about 'board level servicing in the field is inevitably a dying art' sounds pretty harsh, I guess he's right there, too. The change to surface-mount technology, with its increased efficiency for volume manufacturing, is no doubt inevitable for virtually all consumer electronics because of the pressures on all manufacturers to remain competitive. And it's certainly true that SMD boards are really not amenable to field servicing — as well as being a lot more reliable than previous assembly technologies.

All of which is really bad news for many people in the servicing industry, of course. I can imagine such people may well view Mr Tait's final comments, including 'It has some harsh

dimensions, but also great rewards' with some cynicism.

Although those final comments do perhaps sound a bit off-hand — like the sort of comment Henry Ford might have made about the fate of firms who manufactured horse-drawn buggies and saddles, and their employees thrown out of work by his firm's products — I suspect Mr Tait didn't intend them to be taken this way.

More easily seen?

No doubt someone like Mr Tait, who has built up a very successful manufacturing and export firm, is in a better position to see the 'big picture' than someone who has been thrown out of work as a result of the closure of their employer. It's probably also easier to be philosophical and optimistic about the development concerned, when one is nearer the 'great rewards' end of the phenomenon, than the 'harsh dimensions' end.

Don't get me wrong, by the way. I have no doubt that someone like Mr Tait will have achieved his success only as a result of hard work, initiative, and a willingness to take risks and make hard decisions. And I also believe — strongly — that we need *more* such people, to build a stronger manufacturing base in Australia as well as New Zealand.

What I'm suggesting is that such people are relatively rare; many of us are not made of the 'right stuff' to start and build a successful company, and will spend our working lives as employees. But just as it's important for our countries to provide an economic and political environment where people like Mr Tait can start and build their companies, and reap the appropriate rewards, surely it's also important for a compassionate society to look after the rights of loyal and hard working employees?

In other words, I guess I'm suggesting that 'market forces' alone may be too harsh, especially for those at the 'tried and discarded' end of the spectrum. Just as our societies temper the laws of the jungle, by limiting our individual freedoms for the common good, I believe the laws of the economic jungle also need some tempering for the same reason.

But enough of my own sermonising, and let's look at the next contribution. It comes from fellow Kiwi Mr Bruce Stevenson, of Chartwell in Wellington, and as you'll see he firmly believes that Richard Williams is quite wrong in his assertion that a high level of imports reduces local employment:

Your correspondent, Mr R. Williams of Pukekohe, NZ (Forum, May 95) is rather too negative. I started in electronics around 1964, and although no longer particularly active in that area, still read EA with interest. Sorry, I can't let his observations pass without comment!

'Completely fallacious'

We do have social problems in NZ. To debate the cause of these problems is getting into the realm of politics. But I am sure the problems have nothing to do with the level of imports. Mr Williams' assertion that a high level of imports reduces local employment is completely fallacious.

Suppose we import everything and make nothing at all locally. How do we pay for the imports? Perhaps in local dollars. Soon overseas suppliers have heaps of our dollars. How do they get rid of them? Exchange at a bank? Then the banks can't get rid of them. We have just shifted the problem from one place to another.

The only way is for the holders of our currency to exchange these otherwise worthless dollars directly or indirectly for goods and services that we produce. In other words, to buy some of our exports.

We might pay for the imports with US dollars. How then do we get US dollars? Again it's the same problem. We have to export.

Take an imported TV set costing say $500. If we made that exact set locally, it might cost $1000.

If you buy the $500 TV, you still have $500 to spend elsewhere. In buying the import, you are clearly better off. And you do provide some direct employment to the local economy. There's the retailer, distributor, importer, banker — not to mention government bureaucrat!

You also provide other employment that is completely hidden. In buying the import, you are indirectly selling local dollars. Your action forces down the value of the local dollar. In the case of a single TV this drop is minuscule. However, when the effect of your action adds to similar actions by everybody else, many small drops become a whole bucketful. The overall effect of all this importing is to greatly reduce the value of the local currency.

We hear exporters in NZ complaining that our dollar is too high, yet they seem completely oblivious to the fact that they are in part responsible for the problem. They export too much! Exporters always want a lower local dollar. They can then export the same volume of widgets and make more money. Or they can lower their price in overseas currency and export more widgets. This usually means more jobs in the export sector.

Even if exporters provide no more jobs directly, how will they spend this extra cash? Even the most frivolous activities create employment. A wild party? That makes employment for caterers, booze manufacturers, hoteliers and dancing girls. An overseas trip? That makes employment for travel agents, airlines and exporters (by driving down the local currency some more). No matter how exporters spend the extra cash, it provides local jobs for someone somewhere.

Jobs created by imports are in areas where we can foot it with the best in the world. Jobs created by protected local manufacture are in areas where we are uncompetitive. And protected industries have the habit over time of needing still more protection.

Extended over the whole economy, this protection means that we all end up with less money to spend. Think of the $500 TV that costs us $1000, and extend that to a range of other goods. Sure, we would have jobs in the protected industries, but at the expense of those hidden jobs in and supporting the export sector.

When you buy your import, you are indirectly helping our exporters and in turn providing local jobs in completely unexpected places. You can never say "I bought a TV — therefore I provided a job for this person". Whether the TV is made locally or overseas, you provide many tiny fractional jobs for people all over the place. It's just that in the case of the import, the link is not nearly so obvious.

'Nicely self regulating'

This whole process is nicely self regulating. The value of exports just balances imports. If they get out of kilter, the exchange rate shifts to correct the imbalance. Imports become dearer and exports cheaper, or vice versa.

There is only one reason why you should buy a local product. Buy if it offers you the best value for money; otherwise buy the import. You are creating local employment just the same.

I turn now to service technicians. Mr Williams says they are paid lower that the average weekly wage. Consequently, we see fewer young people entering the industry, and others

leaving. I myself am one of those. These factors reduce the availability of technicians, and over time will drive up their price again. This price increase is self-limiting: eventually it reaches a point where enough new entrants are attracted by higher pay and better conditions. Their actions will move the price of technicians down again.

Left alone, this is a fine balance. As with any product, there is sometimes be a glut; the price falls. As the glut clears, the price goes up again. This is a classic case of negative feedback.

Technicians are just one part of the overall economy, which is like a high precision self-adjusting video recorder. A problem fixes itself with appropriate feedback. Allow anybody to 'fiddle with the trim pots' and serious trouble is likely. In previous years, politicians have done this — they called it 'fine-tuning'. One bout of fine tuning leads to another, and in 1984 in NZ it ended in near-disaster.

Electronics has made great strides over the years. Today's gear is much more reliable, and has a lot more bang for the buck. If the cheaper stuff breaks, it is not worth fixing. The dearer stuff can often be fixed quickly with a board or module change. The technician is just a 'board jockey', and the skill level required is lower than in the 60's and 70's.

Sure, old-time technicians may have difficulty finding work as it used to be. Their skills in problem-solving, organising, customer relations etc., can be transferred to other endeavours. Computers for example, where their technical knowhow is also needed. In pure electronics there are still opportunities.

Mr Williams complains about the lack of service information for the wide range of imports. This is not a problem, it's an opportunity! What about getting together with the importers, get hold of the service information and set up a nationwide service centre for some of those particular products?

We live in exciting times, and may it continue.

Well, there you are. Thanks to Mr Stevenson for those comments, which seem broadly in line with those of Mr Tait.

If I interpret him correctly, his basic point is that 'market forces' are automatically going to produce the best possible outcome for everyone, and it's therefore better not to 'tinker' with them. It's just too bad that some people are going to be adversely affected by technical change and its inevitable swinging of the economic 'balance' — they'll have to retrain, or start a company or something. They're just the incidental casualties, or 'collateral damage' and the military would say...

Hmmm. Perhaps *you're* right too, Mr Stevenson, and the current winds of economic rationalism *are* blowing us in the only direction possible in the 'real world'. But it's cold comfort for those who end up being blown away in the process, don't you think?

Local response

The third response that I'm going to present this month comes not from NZ, but Laurieton on the upper NSW coast. And in contrast with the responses from his own country, the writer of this letter *does* give Mr Williams some support. He's Mr M. Thorne, a recently-qualified technician, and although I can't reproduce his full letter (it's a bit long and rambling), here are the sections I thought were likely to be of most interest:

Like Mr Williams said, the backup service from some (not all) of these companies is very bad. They import all this cheap junk and then tell you [when it fails] *that they have to import an IC, etc. from Taiwan. So the poor old customer can wait up to three months, sometimes!*

The scene is getting very complicated especially on hifi 'midi' systems, especially the junk coming out of China, where they wipe out the type number of an IC (or are they generic 'no name' ICs?). Anything made in Japan now is a pleasure to work on (and expensive). Not to mention the soldering produced in some of these Asian countries — it's Novice kit building work.

But like Mr Williams said, it's all based on profit. The public buy this crap because its so cheap. They don't realise that they are ripping off both themselves and their country.

I like to think I'm doing my bit for Australia, by resurrecting a lot of the older gear around. And consequently our wages are not sp good, as the customer can buy a new TV, video or sound system for not much more than the cost of getting the old one repaired, if charged at the standard rates! To make any money, you have to be in a one- or two-man business.

This area is dominated by one-man 'work under the house' repair shops. Thus students graduating from TAFE without an apprenticeship find it hard to get employment. So most are forced to go to the cities, to find work. And when

you ask for a job, like Mr Williams said they always say "I need someone with at least three to five years experience".

I did get a job, but the company went into liquidation. I didn't want to leave the area, so the only alternative was to start my own business. But it's hard when you only have limited experience, and there's no senior tech to say "Oh yes, this is the problem with this model..."

So all I can say is, kids, get into building those kits, etc. Get your hands dirty, because you need to know how to use a screwdriver and pull things apart, as well as a brain full of theory. Then maybe one day, we will make TV's and videos and sound systems here, with a good backup service, and start kicking arse again. It's up to us!

As you can see, Mr Thorne is more or less in agreement with Richard Williams in a couple of areas, but seems to be somewhat more optimistic about the future. It's encouraging to hear that he has started his own servicing firm — that takes quite a bit of courage, and I for one wish him well.

Back to Mr Williams

And now, before we end up, I thought we'd let Richard Williams have the opportunity to clarify a couple of the points he made in the May column. These further comments are taken from a second letter Mr Williams has sent me, and I draw them to your attention because they reflect his viewpoint — which is rather different from that of either Mr Tait or Mr Stevenson. His letter is again rather long, but I've extracted the sections that seem to be most appropriate:

Most New Zealanders have always had a 'she'll be right' attitude, which is part of our national heritage. Nothing's a bother, don't worry about it. Unfortunately it is this casual attitude which has allowed hard hearted Labour and National governments to push through worldwide trends in right-wing economic policies — leaving the marketplace to determine supply and demand, and to decimate trade unions with the Employment Contracts Act (or as many put it, the Unemployment Contracts Act). This basically allows employers to pay whatever they like, and has ruled out most overtime and penalty rates.

When firms found they could pay low wages with no action from unions they did just that, and in addition called for staff to work much harder and for longer hours — or on call with only a survival wage... New Zealand workers have found out to their cost that they are not human beings any more; they are disposable units in an economic system designed to run at maximum efficiency. The marketplace economy is not driven by social requirements of society, it is driven by profits.

The situation with electronics technicians in New Zealand, of which I am very familiar, is deteriorating rapidly. Sales of new imported products has assumed far higher priority than repairs, by retailers and distributors. In the Auckland area, the largest population area in New Zealand, 90% of retailers have either closed their service department or downgraded it to a low priority with wages to match. This causes technicians to leave for other work, which eventually leads to the retailer closing the service department and contraction servicing to a larger service organisation.

My experience has been that the larger service organisations have already closed their doors, or are preparing to do so, which will leave consumers totally dependent on imported replacement goods rather than repairs.

At the same time as our experienced electronics technicians are heading for the hills, together with very low numbers entering the industry, our politicians and business leaders are saying that we must export more value added products. We must find ways of manufacturing products which are technically innovative, and most of these goods require electronics in some form or other.

This situation of downgrading our own electronics technicians, but at the same time calling for more exports — many of which will require electronics as a key ingredient, and in addition removing the local electronics base from which young people can learn the trade and mature into experienced and capable technicians, is a problem with no conventional solution. It is a problem that is never intended to be solved. Marketplace economic policy is not there to win friends and influence people; it is there to make wealthy people more wealthy.

Well, there you are. A very different point of view from that expressed by Mr Tait, I think you'll agree, but expressed with an equal degree of sincerity and conviction. Thank you for those further comments, Mr Williams.

Could both be right?

By the way, it occurs to me that quite possibly they're *both* right, and the apparent conflict occurs because they're each only describing a limited aspect of the same reality. But exactly what that means in terms of the future for many of us, in both New Zealand and Australia, I'm not sure.

I think we'll leave the subject there for the moment, though. Next month I'll try to steer Forum back to safer technical waters, where I for one won't feel so far out of my depth!

I hope you'll join me then. Don't forget that you can now send your contributions to Forum in quickly by modem (ASCII files only, please) to our Computer BBS on (02) 353 0627. ❖

NEW KITS FOR EA PROJECTS

FROM JAYCAR ELECTRONICS:

PC-Driven Electrocardiogram (July 1995): The Jaycar kit includes PC board, case, silk screened front panel, DB-25 plug and all components, as described in the article. Catalog number KA-1774, it is priced at $34.95.

Flexitimer Mk2 (August/September 1995): The Jaycar kit includes PC board and all specified components to build all options, including a relay. Catalog number KA-1775, it is priced at $22.95.

Parallel Port Breakout Box (August 1995): The Jaycar kit includes both PC boards, case, DB-25 connector and ribbon cable, plus all specified electronic components. Catalog number KA-1776, it is priced at $45.00.

FROM DICK SMITH ELECTRONICS:

Flexitimer Mk2 (August/September 1995): The DSE kit is a 'full version' with PCB and components to build all options, including the AC powered version. A relay, DIP switches and IC sockets are included. Catalog number K-3596, it is priced at $29.95.

LED Battery Voltage Indicator (September 1995): The DSE kit consists of the PCB and all components. Catalog number K-3118, it is priced at $6.95

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NEW BOOKS

Cellular 'bible'

THE CELLULAR RADIO HANDBOOK, Third Edition, by Neil J. Boucher. Quantum Publishing, 1995. Hard covers, 287 x 220mm, 772 pages. ISBN 0-930633-16-4. RRP $260 including postage.

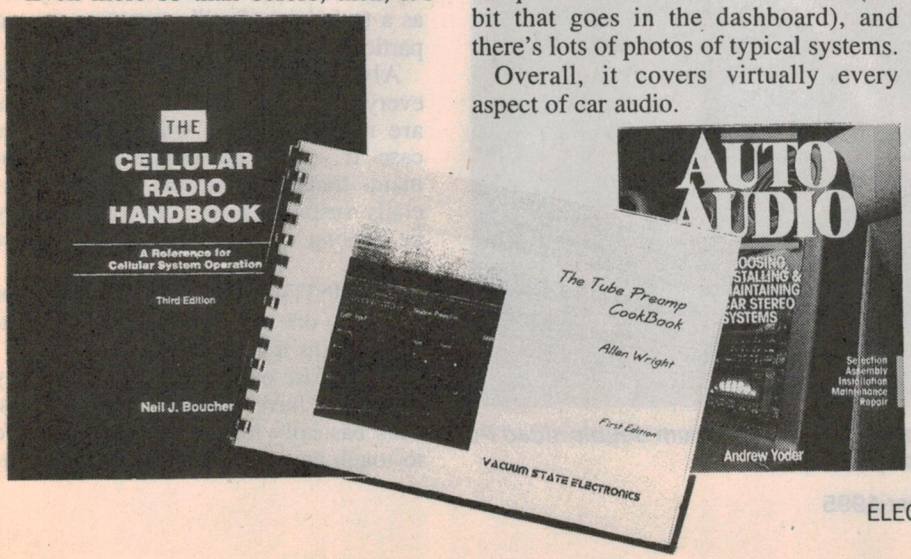
Australian Neil Boucher is a recognised world authority on cellular radio systems, having been heavily involved in planning and setting up Telecom Australia's systems when he was an engineer with Telecom Australia, and also in advising many of the Asian countries as chief ITU technical adviser for cellular radio in the South-East Asian region. The first edition of this massive handbook was published in 1990, and when we reviewed it then we were very impressed; it seemed to cover just about every possible aspect of the subject.

Since then, and not surprisingly, it seems to have become the accepted 'bible' on cellular radio technology, around the world. However this wide acceptance has brought with it an obligation, on the part of Mr Boucher, to keep it updated — not an easy task, in a field where the only certainly is rapid change.

Essentially it's been completely revised and updated, and now contains roughly twice as much as the first edition. There are nine new chapters (making a total of 51), and as you'd expect a great deal of emphasis on the various digital technologies that represent the future — including GSM, DAMPS, NAMPS, CDMA and E-TDMA.

Even more so than before, then, it's about as comprehensive and up to date a reference on cellular radio that you're likely to find anywhere.

In Australia, it's available from DNA Communications, of PO Box 649, Maleny 4552; phone (074) 999 535 or fax (074) 999 534. (J.R.)



Car hifi systems

AUTO AUDIO: Choosing, Installing & Maintaining Car Stereo Systems, by Andrew Yoder. Published by McGraw-Hill, 1995. Soft cover, 187 x 235mm, 338 pages. ISBN 0-07-076536-7. RRP $52.95.

The author of this comprehensive book on the very popular subject of car audio claims it to be for the layperson, but it does discuss quite a lot of technical matters, such as filters (Butterworth and so on), Ohm's law and even aspects of speaker design.

There are complete chapters on car amplifiers, speakers and their enclosures, filters and crossovers, antennas, wiring and installation, as well as maintenance and repair. The book starts by warning the reader of possible hearing loss from exposure to high sound levels, ending with the line: "If you think this section is intended to scare you, you're right."

Some chapters, like the first on how and where to buy a system, are mainly relevant to the US market, but still contain useful information for Australian consumers. The book looks at typical audio equipment, including car CD players, cassette decks, even DAT decks. Installation diagrams are given for quite a few brands of head units (the bit that goes in the dashboard), and there's lots of photos of typical systems.

Overall, it covers virtually every aspect of car audio.

The writing style is also friendly and easy to read. The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. (P.P.)

Valve audio

THE TUBE PREAMP COOKBOOK, by Allen Wright. First Edition, 1995 published by Vacuum State Electronics. Plastic comb binding, 300 x 211mm, 122 pages. RRP $49.50 including postage.

Back in the 1970's, New Zealand-born Allen Wright ran an eponymous business in Australia building and modifying up-market hifi equipment. By around 1980 (about the time most of us had finally pensioned off our old valve amps), he apparently became convinced that valve technology was superior for achieving 'the very highest' pinnacles of reproduction. As a result, he began custom manufacture of high-end valve equipment 'for real music lovers'.

Nowadays he lives in Europe, where it appears he gives seminars, produces educational videos, and generally lives the life of a successful hifi 'guru'. This book seems intended to convey much of his considerable practical experience in designing, building and 'tweaking' valve hifi preamps.

It's a somewhat idiosyncratic book, to say the least, and laced with the kind of pontification beloved by 'subjectivist' hifi zealots and the quirky industry they attract. Some of the justification given for his more outlandish claims tends to be pretty weird, too. But on the other hand, there's a fair bit of technical commonsense evident as well — along with a great deal of stuff that's both thought provoking and entertaining.

The production of the book lets it down a bit, with quite a few hand-drawn schematics augmented by barely-decipherable legends and notes. On the whole, though, it's a book that will probably interest and entertain (possibly also infuriate) just about anyone with an interest in the technicalities of high quality audio.

It can be obtained by mail from Class One Productions, of PO Box 145, Woy Woy 2256; phone (043) 43 5488 or fax (043) 41 1129. (J.R.) ❖

Tips from an experienced technician:

DO IT YOURSELF FAULTFINDING & REPAIR

Many service technicians are unwilling to pass on any of their hard-earned expertise, on the grounds that helping people fix their own equipment is simply doing themselves out of work. However the author of this article (an experienced technician) decided to risk being burnt at the stake by his colleagues, by passing on these valuable 'basic rules' for successful faultfinding — on the basis that if you *are* going to tackle your own CTV or your mother-in-law's VCR, you should at least *look* as if you know what you're doing!

by DAVID REID

Electronics is one of those subjects about which the general public tends to remain totally ignorant. Most people feel more at home with heart transplant technology than they do with the concept of radio.

And from that ignorance stems the assumption that someone who knows 'all about electronics' ought to be able to repair anything electronic... Consequently, the fact that you read *EA* makes you the logical person to fix your neighbour's television, or your mother- in-law's VCR, even though you may actually design error-correcting algorithms for a telecommunications company!

Chances are you don't even own a soldering iron. So, when a friend asks you whether you would mind having a quick look at his telly, you generally have two options.

You can politely decline and explain that it's not really your field, and that it should be seen to by an expert; or you grab a screwdriver and spend a couple of hours poking around inside, after which you say "look, it's not really my field, and it should be seen to by an expert".

As a result, many people with considerable knowledge of electronics will not even attempt repairs such as these. Yet the reality is that, armed with no more than a systematic approach, these same people should be able to successfully complete at least half of the repairs they attempt.

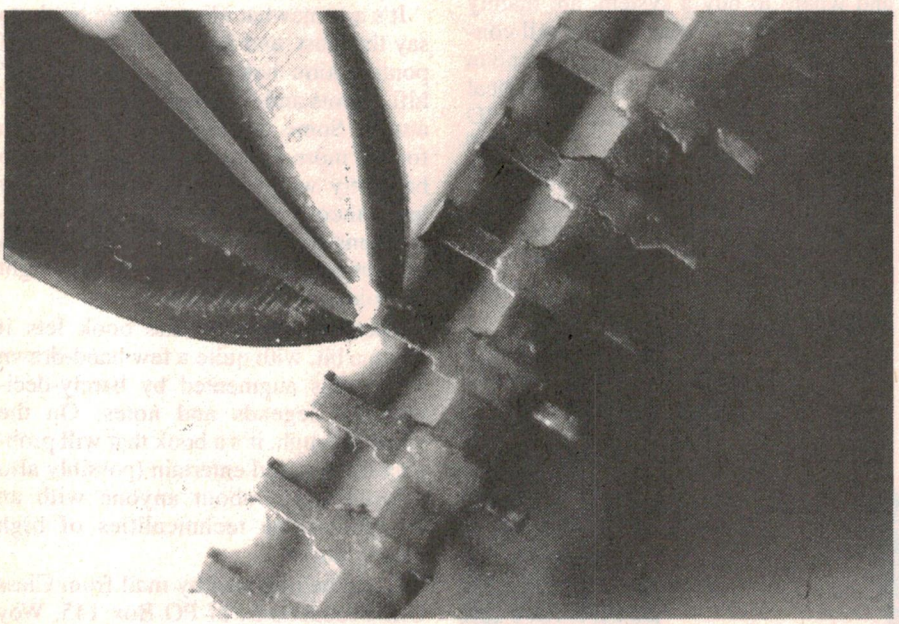


Photo 1: The only really safe way to remove components from double sided PC boards is by cutting the individual device pins.

Playing it safe

No matter what previous experience you might have, never attempt to dismantle any unit with the mains connected. There are a couple of reasons for this. Even if you are intimately familiar with the unit, and know that there are no exposed mains connections inside, it is very easy to inadvertently touch exposed circuitry with the metal lid, or even drop a screw inside. It's bad enough having to admit defeat, but the last thing you want to do is admit that you induced another fault into the bargain...

Similarly, never power up a dismantled unit until you are absolutely certain of the voltage distribution within it. Ideally, mains terminals should be insulated at manufacture, but more and more frequently you will find that mains transformers are PCB (printed circuit board) mounted. After 11 years as a technician, I still wrap tape around particularly exposed terminals.

Always treat a power supply as if every component could be live, as there are many supplies where this is the case. If you do not find a decent-sized mains transformer in the unit, be especially suspicious, as you will probably be dealing with a switch mode power supply.

(DEFINITION: A switch mode power supply is one that doesn't use a decent-sized mains transformer.)

In the case of colour televisions, they frequently have a live, or 'hot' chassis. This basically means that it is not safe to touch any part of the electronics, in-

cluding anything that looks like an earth, while the set is operating.

If you feel uncertain as to the nature of a power supply, my advice is simply to limit yourself to passive tests and measurements with the power off. (Watch very carefully for high voltage electrolytic capacitors. They are common in switch mode power supplies, and can hold a sizable charge for some time; 300-odd volts of DC can easily blow the corner off your favourite screwdriver.)

Finally, don't work alone if you can possibly avoid it. A portable safety switch is a good investment. And don't hesitate to ask for children to be removed from your vicinity, as they can be a dangerous distraction.

A little forethought

A frustratingly high percentage of faults are intermittent, or become intermittent as soon as a technician enters the same room. For this reason, try to keep your screwdriver holstered for a few minutes while you get a better idea of what the symptoms are. Check every function on the unit in question, as many faults have multiple symptoms which, taken collectively, point directly at the faulty circuit.

As an extremely simplistic example, consider a cassette deck which has no sound at the line output sockets. A thorough check reveals that the tape advances normally, the meters show activity of some sort, and sound can be heard through the headphones. Now, a minute of thought should produce some of the following conclusions: the heads work, the preamps work, the mechanism is OK, the headphone amp is functional, and the power supply is generating most, if not all, of its voltages.

Because there is no sound at all, you will be looking for something common to both channels. Finally, you dismantle the unit, only to find that the fault has gone. But are you worried? No, because you have a fair idea of where you are headed anyway. Already, you have eliminated 95% of the possibilities, and close inspection of the board near the line output sockets reveals a microscopic hairline fracture. You repair the tape deck and confidently hand it back over the fence to your neighbour. At this stage, your biggest problem will be coping with everybody telling you how clever you are.

Similarly, a full check of the symptoms can be time saving in a different way entirely. Suppose the meter lamps hadn't worked. This might have been evidence of a power supply problem. Always have a crack at the simpler problem first. And never assume that you will get an accurate description of the fault from your 'client'. Often, they know very little at all about the fault, as the public's most common reaction to the failure of any appliance is to switch it off, in case it 'blows up' (hence the term 'exploded diagram').

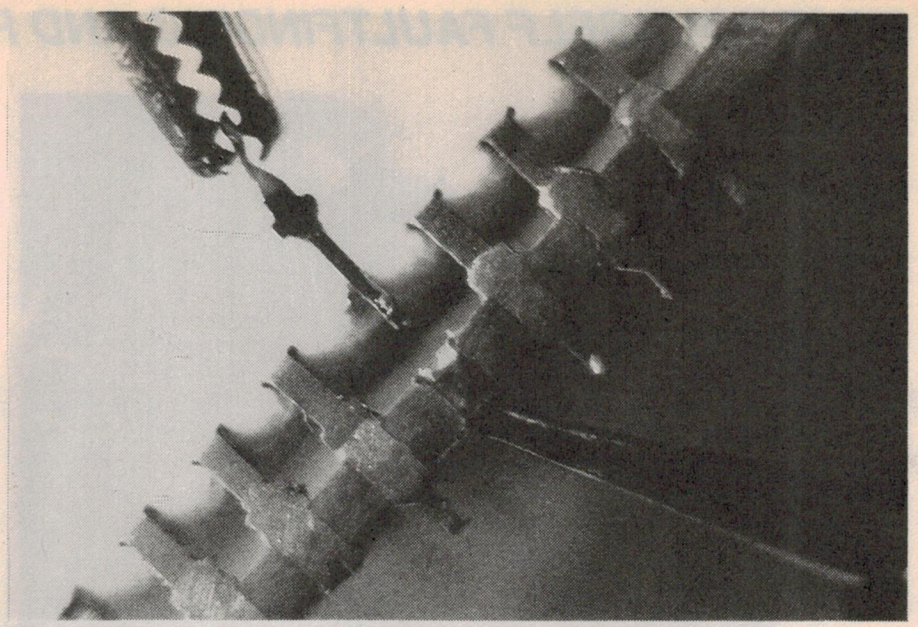


Photo 2: Once the pins are all cut through, the component can easily be removed from the board, and the pins also removed easily.

I realise that all of the above presupposes a certain understanding of how a tape deck works, but you should get the general idea. And although I said it was a simplistic example, this type of fault is commonplace in the repair industry.

The other considerable advantage of this sort of approach is that it enables an accurate assessment of the condition of the unit to be made, before too much time and effort is wasted. Suppose the checks had revealed that the heads were worn, one channel was distorted, the meter lamps were dead, and the motor speed varied all over the place. A quote in these circumstances would frequently be rejected.

Look, listen, sniff

It is surprising how many faults can be found by simple observation. Again, restraint is the order of the day, so have a very careful look around before you start exploring with your meter. You might find a plug that isn't seated properly in its socket, or a solder splash bridging two tracks on a PCB. In either case, the fault could rectify itself while you are attempting to fix it.

In many cases, the faulty components actually *look* faulty; transistors that have been operating in melt down mode, electrolytic capacitors that are swollen or ruptured, or resistors that are burnt and blackened. In the case of the latter, do not touch the resistor until you have had a chance to carefully measure its resistance.

These overheated resistors exhibit a nasty tendency to disintegrate at the slightest provocation, leaving you with no idea of the original value. Regardless of how well you learned your resistor colour code, 'black-black-black' is always a bugger to figure out.

Connections

As much as we technicians tend to snigger when the customer naively says "I think it's just a blown fuse or a broken wire", the reality is that poor connections of one sort or another *are* responsible for a huge proportion of faults, and in most cases the customer is on the right track, but using the wrong terminology.

These bad connections come in a multitude of forms, the most common ones being dry solder joints, plugs and sockets (dirty or badly crimped, including PCB edge connectors and IDC plugs), switches, PCB fractures and dirty pots, to name a few.

This brings us to the question of contact cleaning. There are dozens of different contact sprays around, and they all excel in their specific applications. However, with one exception, they can cause all sorts of trouble when used inappropriately.

The only type of spray that can be used with confidence in most circuits is

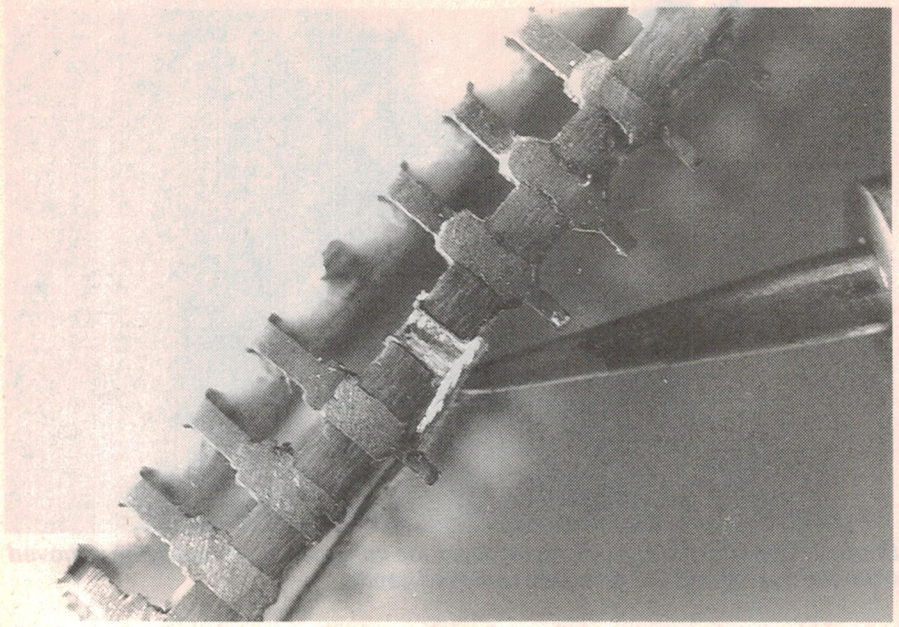


Photo 3: Finally, remove all remaining solder carefully using desoldering braid, before attempting to fit the replacement part.

one designed for cleaning television tuner contacts. So don't be tempted to fill your VCR with something designed for auto electrical systems.

There are two cases where contact cleaners of any type should be used with caution: slide potentiometers, and conductive rubber switches.

In the case of the pots, contact cleaners wash the lubricants out along with the dirt, causing them to stick and bind. It is often possible to drop a tiny amount directly onto the carbon tracks. This often cures them. The switches mentioned can be hard to recognise, but they are being used so frequently these days that it is better not to clean any switch unless you are reasonably sure that it has metallic contacts.

A final word or two on the subject: I have had three memorable experiences involving sprays. On the first occasion, I was using a common furniture polish to spruce up an electronic organ. As I wiped the rag across the faces of the tabswitches, the red lettering which was embossed into the faces of the switches simply disappeared!

On another occasion, also with an electronic organ, a customer decided to try spraying the key contacts himself. However, the spray also covered the backs of the plastic keys. To cut a long story short, the keys on these organs have a return spring which lifts the keys back up after they have been played. This places a fair bit of tension on the backs of the keys. The spray which the customer used chilled the keys to the point where they became brittle and snapped! It was not the sort of thing that one would have been able to predict, but it does illustrate that you should always do a small-scale test, if in doubt.

Finally, a totally predictable near disaster caused by yours truly. My wife had been complaining of some intermittent fault in the washing machine. (I made the mistake some years ago of successfully performing a complete overhaul on our machine. Consequently, I no longer have the luxury of feigning ignorance when the machine goes down...)

I wasn't in the mood for any serious faultfinding, so I removed the top cover and soaked the beast with my favourite contact cleaner. I then leaned up close to observe the results of my handiwork, and hit the 'go' button. The 'explosion' that ensued was worthy of Francis Ford Coppola. Although I knew full well just how flammable the substance was, I had not anticipated the healthy arc produced when the open switch contacts closed. I was unharmed, and considered myself fortunate that I learned my lesson in an outdoor laundry, rather than in a customer's living room!

The ubiquitous dry joint

Ubiquitous: *u-bi'kwi-tus. (adj). Existing or being everywhere; omnipresent.* I realise that dry joints (DJs) may only be ubiquitous in consumer electronic equipment, and I like to think that industry and the military have slightly more reliable soldering in their gear. Nevertheless, I have seen so many dry joints in so many places, that I pray every night that all of the really important switches in Russia and the USA have normally *open* contacts. (Think about it...)

As common as they are, DJs can be very hard to locate, as many perfectly sound joints *look* dry, and often a crook joint looks fine.

Fortunately, some components tend to form DJs more frequently than others, so you can usually save time and effort by looking at the most likely culprits first. These are basically any components which are physically large, conduct high currents, and get hot. Of course, the three usually go hand in hand. The expansion and contraction associated with heating and cooling can fatigue joints, as can the vibrations from improperly secured 'large' components.

You will frequently find that the PCB is discoloured beneath 'hot' items. Consequently, the sort of areas that are worth inspecting are power supplies, amplifier output transistors and drivers, servo motor drive transistors, TV line output transistors, and so forth.

One growth area in modern equipment is DJs on surface mounted devices (SMD). But don't even go near these beasties unless you have had experience. Reworking SMD boards requires patience, dexterity and acuteness of vision, as well as the right equipment. If you think that you are good enough to have a crack at it anyway, maybe you ought to think about getting into brain surgery. The pay's better, and the customer doesn't complain as much when you stuff it up. In fact, the customer usually doesn't complain at all...

Technically speaking, the best way to rework a DJ is to completely remove the old solder, clean the joint, and then resolder it. In the real world, most of the time you will get away with reheating the old joint and adding a little fresh solder. If the joint doesn't look right when you are through, you can always go back and do it the hard way.

While we're on the subject of soldering, one of the greatest causes of damaged PCBs is the double-sided board. Unless you have a good vacuum desoldering station, the only safe way is to carefully cut the component's pins

off one by one, and then desolder them individually, as the accompanying photographs illustrate. Clearly, this doesn't do much for the resale value of the component!

Of course, all of the above presupposes that you have found a dry joint to resolder. If you cannot locate it visually, a little freeze spray often helps. I love to squirt a little freeze spray around, then write 'thermally cycle unit in attempt to locate faulty component' on the invoice. It never fails to impress!

Gentle tapping of components or the PCB with a (nonconducting) screwdriver often helps to localise the fault to a particular area. And if all else fails, you can always try tracing out the fault.

Fractures

PCB fractures can be difficult to spot, as although they are often quite obvious, you occasionally get a hairline fracture which can be almost impossible to spot. If gently flexing the PCB seems to have an effect on the fault, then you may well be looking for a fracture.

In this case, try removing the board completely, and looking at it with an intense light behind it. Many boards are translucent to some degree, and frequently, when backlit, the fracture will stick out like the proverbial male canine's genitalia.

Once again, physically large components are more likely to have fractures beneath them. Also, look closely around any mounting holes, and any components which protrude into the 'outside world', such as volume controls, input and output sockets, etc.

The repair of fractures is an art in itself, and a shoddy job can introduce more problems than it cures. Modern equipment often has very fine tracks, narrowly spaced.

The real trick is to get the tracks really clean on both sides of the fracture; an ink eraser will remove the solder mask from the tracks, and polish the tracks beautifully at the same time. Tin the tracks, using an absolute minimum of solder, and tack down the finest tinned copper wire you can get your hands on. We routinely use three-amp fuse wire.

Component failure

Even without a schematic, it is possible to pin-point many component failures, once you know where to look. Those same components which I mentioned as being prone to DJs are also the most likely to fail. The most reliable electronic appliances are those with little mechanical complexity, and low power consumption. Hifi tuners and equalisers are generally more reliable than amplifiers and tape decks.

To begin with, don't get too theoretical with the problem. Check the components which seem to have some bearing on the problem, starting with things like output transistors, rectifier diodes, and so on. Desolder at least two legs of any transistor before measuring it. Any low value resistor is worth measuring. Often these are used as fuses in low voltage rails.

Electrolytic and tantalum capacitors are also worth a look. These capacitors are often used to provide localised filtering of power supplies, and can present real problems when they go short circuit. A short circuit on a 5V rail can be a nightmare in a digital circuit, but always look at the bypass caps before you start removing LSIs. Most capacitors have at least 38 fewer legs to desolder!

Perhaps surprisingly, you can often determine what voltages should be present in a circuit without needing a schematic. What you do need is a degree of familiarity with the components involved. Three terminal regulators are wonderful devices: they have their voltages printed on them. Integrated circuit families usually work off predictable rails, so a quick peek at pin 14 of most TTL IC's will often save lots of stuffing about.

Look for other old standards, such as LM741's, 555 timers, etc. Even if you have no idea what an IC does, it should usually have some sort of supply rail on one of the pins! Because much consumer equipment these days tends to be under-engineered, you often find that filter electro's in power supplies are working very close to their rated voltages, so that a 4700uF 63 volt cap in the power supply is probably not going to be filtering the five volt rail.

Transistors usually fail either open or short circuit, so don't worry about beta, h_{FE} and all that other stuff you learned about unless you want to make a career of one repair.

Diodes frequently go leaky, and this is easily checked with a meter; but make sure you are measuring leakage, and not the resistance between the fingers on your left hand and those on your right. Resistors tend to go O/C, and mostly these will be either very low or fairly high in value (less than 1k, or more than 100k).

This may sound like a very simple approach, and may lead you to think that there is not much science involved in electronic equipment repair. However, the really hard repairs can present such a challenge that a busy technician won't have the time to worry about 'style' on the easy ones.

Dead shorts

Nightmare time! A short circuit on a power supply rail can be one of the most difficult faults to find. Imagine a shorted bypass capacitor on the 5V rail, on a good sized logic board. In this scenario, practically every single component will be connected directly to the rail; logically, any one component could be the culprit.

However, a systematic approach is

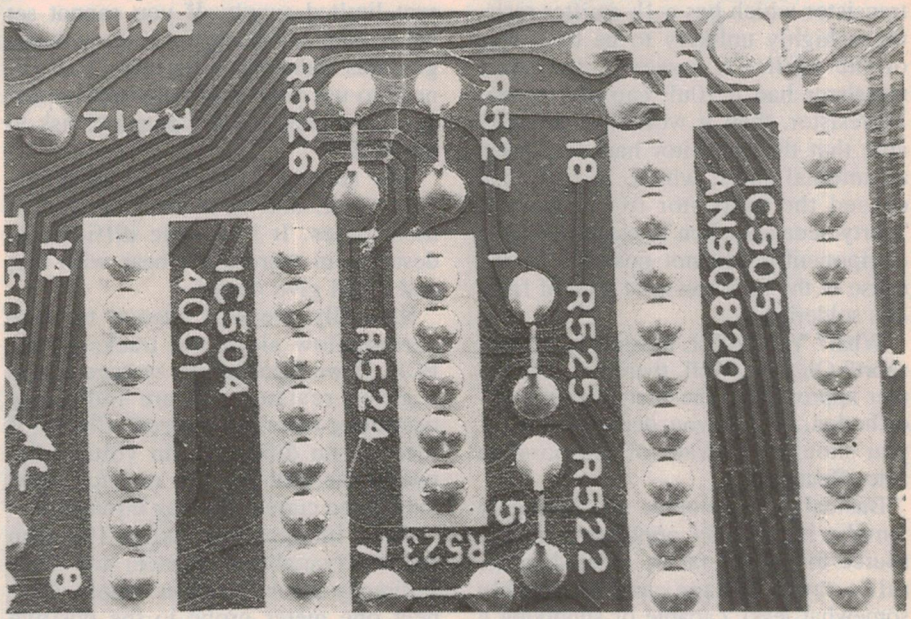


Photo 4: The fracture on this board is far from obvious in normal light, and it is hard to see exactly where it starts and finishes...

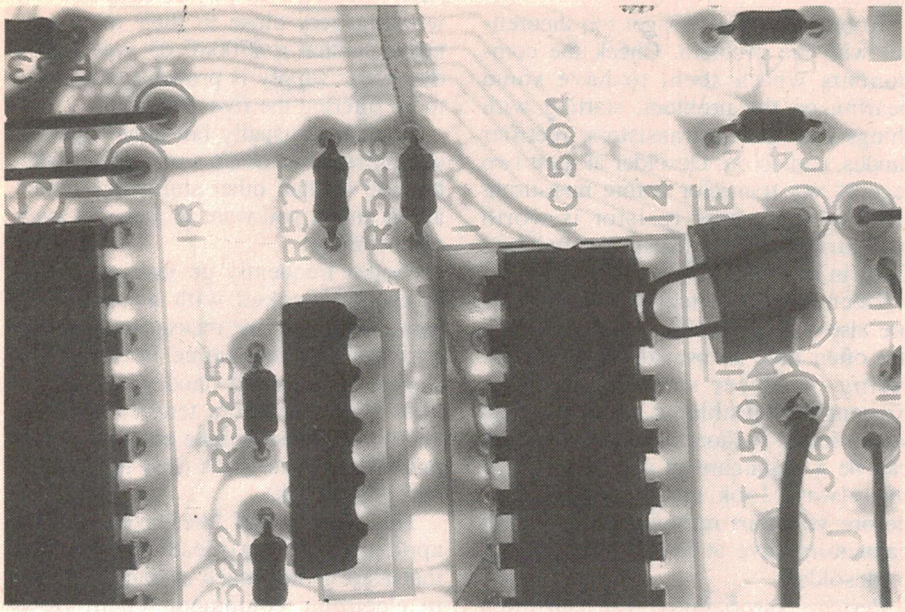


Photo 5: However, backlighting the board with an intense light reveals the true extent of the fracture.

available. The real trick is never to admit defeat.

First, disconnect every single item which is not soldered in. Plugs and sockets, edge connectors, socketed ICs, etc. Check the resistance to ground after each removal. Next, desolder 'easy' components — large electro's, regulators, transistors, and so on.

If you have access to a schematic, use logic (the intellectual type, not the electronic type!). If your short circuit measures only a few ohms, then a transistor which has a 1k emitter resistor is highly unlikely to be the cause of the fault. If, however, the same transistor had a 10uF cap *across* that 1k resistor, then it would be conceivable that the capacitor had developed an internal short, which, in turn, had caused the transistor to go shorted. Thirty seconds taken to establish that a component could not possibly be the cause of the fault can save a lot of fruitless soldering...

What? You STILL haven't found that short? Oh dear. Well, there are two further approaches. The first is a little unorthodox, and if you decide to try it, you should be aware of the possible side effects.

Basically, it involves attempting to 'smoke it out'. By applying a power source to the rail (at no more than the rail's rated voltage, and preferably somewhat less), capable of supplying a reasonably high current, it is often possible to heat the shorted component enough to cause it to smoke, or at least enough to be felt as warm. However, you should know that you could be forcing PCB tracks to carry considerably more than their rated current. In most cases, I am reluctant to use more than 500-odd milliamps.

As long as you do not exceed the rated voltage of that particular rail, the other components on the rail should be safe enough, even if the short should actually burn itself out. Of course, this assumes that you have access to a current limited supply. If you cannot set the current separately from the voltage, give this technique a big miss. You will need to use your own judgment on this one, as it does involve potential risk to the PCB.

The second approach is considerably safer, and is to be preferred in most cases. It is a little difficult to describe in words, but bear with me, and I will give it a go.

Basically, we will attempt to trace current flow along the tracks of the PCB. If we measure the voltage across a given resistor, we are indirectly measuring current — agreed? Clearly, if there is no difference in voltage between the ends of the resistor, then there is no current flowing through it.

Now, imagine we take a 100-ohm rheostat (variable resistance) and place it directly across a power supply. Connect one meter probe to the positive side of the supply, and gradually slide your other probe along the rheostat from the positive terminal towards the negative. If you hadn't already guessed, the voltage would steadily increase from zero at one end to full rail at the other. Please bear with me. I am not being facetious or condescending.

Now, suppose instead of the rheostat, we placed our shorted 5V power supply rail across the power supply. Exactly the same thing would happen! We are simply regarding the printed tracks of the PCB as a very low value resistor.

So if we trace the voltage drops along the track, always following paths which show a greater voltage drop, then we should eventually come to the offending component. Obviously, there will be many forks and branches along the way: the trick is to realise that if the voltage suddenly seems to have ceased increasing, then the branch that you are following will not be the correct one. Simply backtrack to the last intersection and try again.

A couple of points about this method: the voltage drops you measure will be small, unless you use such a high current as to risk damaging the PCB.

I often use a normal 9V battery (NOT a NiCad!). As soon as this is connected across the rail, the terminal voltage drops, depending on the severity of the short, to a very low value, typically around 50 or so millivolts. This is still enough to localise, if not actually find, the cause of the short.

In the hypothetical case where we suspect one of a number of components, it may be quicker to measure the voltage on each component, rather than laboriously tracing out all of the PCB tracks.

Know your test gear

I am continually surprised to see experienced, fully qualified technicians making fundamental mistakes in taking measurements. Because we mainly use high impedance digital meters these days, many of us tend to be blissfully ignorant of the bad old '20kohms/volt' days, and usually, this is a blessing. However, a DMM's 10M input impedance is still a long way from being an open circuit, and loading effects can still happen.

Similarly, few crystal oscillators function properly, if at all, unless your oscilloscope probe is set to the X10 position. Nevertheless, I saw a very senior Technical Officer employed by a major manufacturer, who was unaware of the loading effect.

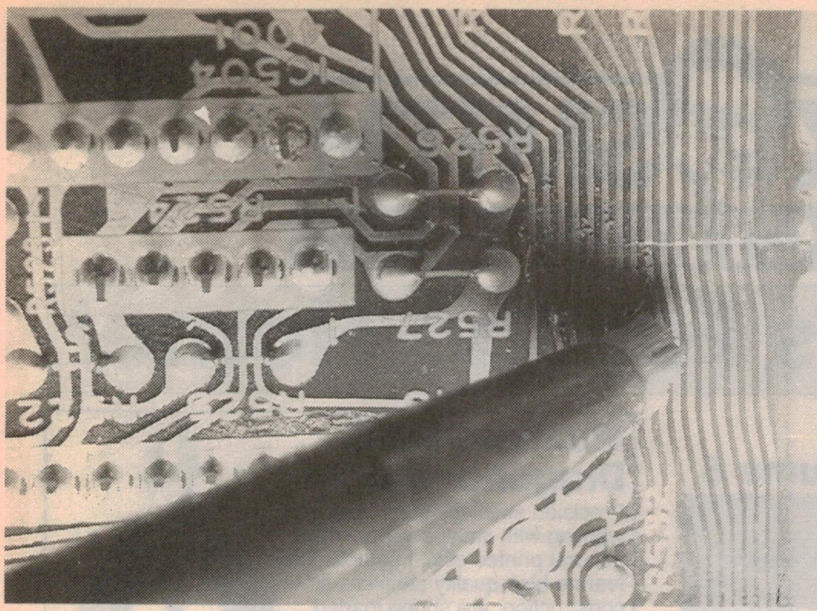


Photo 6: Before attempting to repair damaged PCB tracks, it's essential to get the damaged area really clean.

Many of us tend to think in terms of a voltage being either AC or DC. I prefer to think of each of them being a special case of the other, and this helps to avoid all sorts of embarrassment.

If you have a square wave oscillator which will go down to 5Hz or 10Hz, and access to an oscilloscope, then put the CRO on AC input coupling and run the frequency down from 1000Hz until you cannot go any further. This should be required viewing for any student of electronics. Also, even though you probably know that you should use DC coupling when trying to measure a DC component in a waveform, this is entirely dependant upon the earth being a true earth. Much audio gear has the electronic earth capacitively coupled to the chassis earth.

A typical multimeter will have poor frequency response on its AC volts ranges. Years ago, I lashed out and bought myself a Fluke 77. Some time later, when I needed to routinely measure audio waveforms, I was disappointed to discover the limitations of a response that rolls off around 3kHz. (Don't quote me on that figure!) The Fluke is a marvellous piece of gear, but I was surprised to find just how much you need to spend on a meter to get decent bandwidth.

Nevertheless, I recently found myself working on an electronic organ which had no audio. I had no signal tracer, and the CRO was out in the car. All I wanted to know was whether there was audio getting to the speaker. I simply hooked my Fluke across the speaker teminals, selected its woefully inadequate AC volts range, and pressed one of the bass pedals on the organ. Because the pedals produce very low pitched audio tones, the meter responded beautifully. To paraphrase Clint, "A man's just gotta know his equipment's limitations".

Good manners

Let us now assume that you have found your fault. It is a component you have never seen before, shaped like a bifurcated dodecahedron, and has six legs (and 10 eyes). You are reasonably certain that you haven't seen it in DSE's catalog, and so you trundle on down to the local repairer's place.

Initially brimming with pride and feeling that you are now a fully fledged member of the electronics elite, you are deflated by the manager's attitude. In fact, you get the distinct impression that he would rather you left his shop, and, if possible, fell under a bus shortly thereafter.

It should always be remembered that most technicians will feel that they are losing money by helping you to repair your own product. They are usually right. There is no money to be made in component sales, especially if it an esoteric component. This usually entails looking up an equivalent part number, then a search through catalogs, finally a call to order the part (usually STD), and often freight as well.

Tack on to this the fact that his time is probably worth nearly one dollar per minute, and his suspicion that you might blow the component up anyway, and you might begin to realise that the $10 minimum charge is not such a ripoff after all.

By all means, cultivate any contacts you can make in the trade, but realise that what may seem to be perfectly reasonable behaviour to you may make you seem like a first class pain to others...

The electronics repair industry's most valuable commodities are its time and knowledge. If you are aware of this, you are less likely to waste the first, or to expect to receive the second for free.

There is an excellent reason for being particularly nice to your local technician, and that is that, in spite of everything, you may need him to repair the unit after all. If you do need to bring it in for service, be brutally honest. Write down absolutely everything that you have done to the unit, and make particular note of any problems that you suspect you may have introduced.

If you have lifted a PCB pad or two, admit it and apologise. I can assure you that it will be worthwhile. The technician who has never lifted a track, or introduced a fault, has not performed many repairs, and he will appreciate your honesty.

Oh, and one more thing. A technician may lend you his car. He might even lend you his wife. But it is a brave man indeed who asks for a loan of his service manual. And if you are fortunate enough to have a good relationship with a working tech, don't abuse it. Send him some flowers occasionally! ❖

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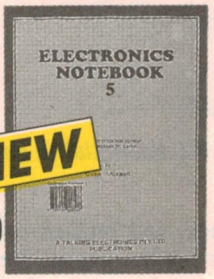

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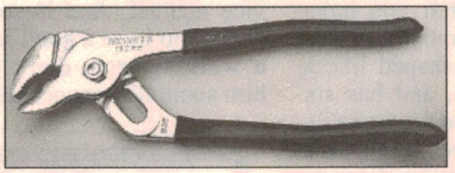

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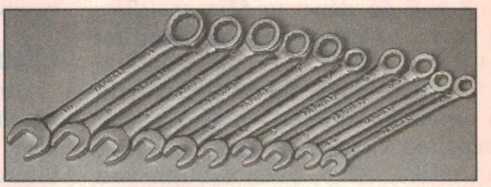

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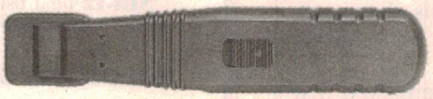

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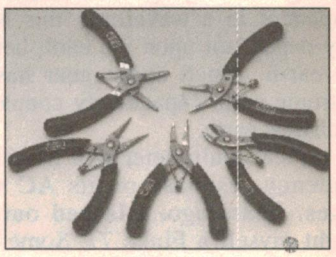

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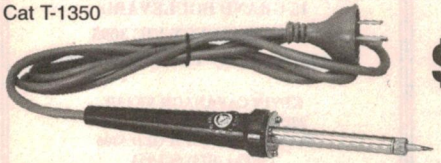

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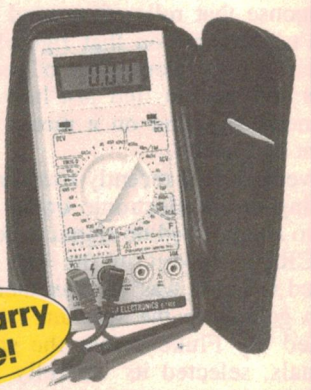

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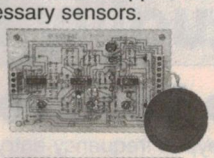

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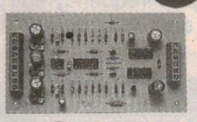

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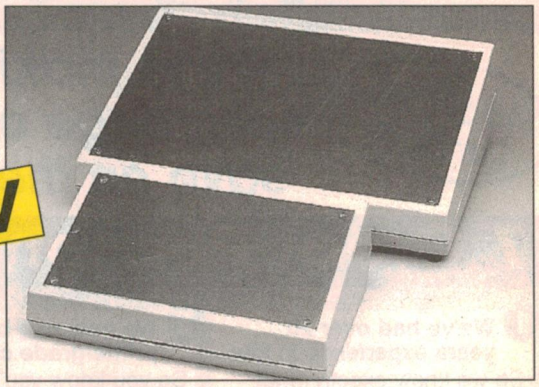

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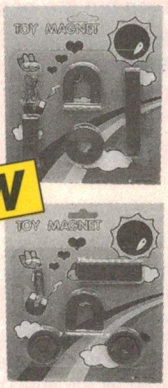

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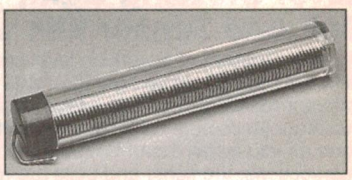

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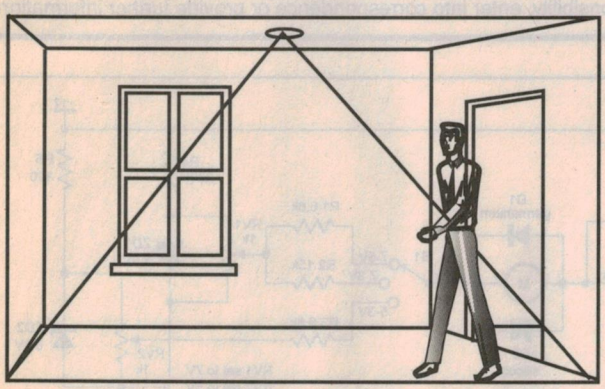

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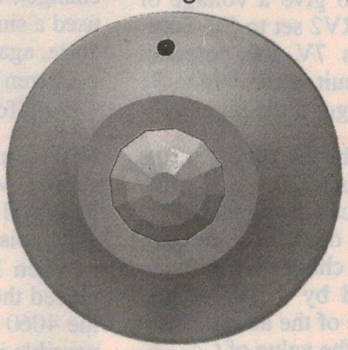

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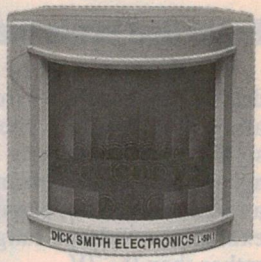

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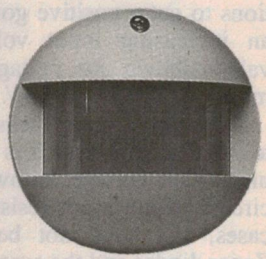

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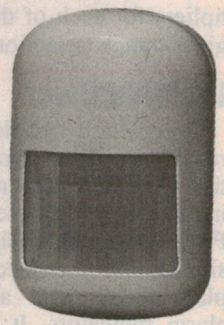

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Circuit & Design Ideas

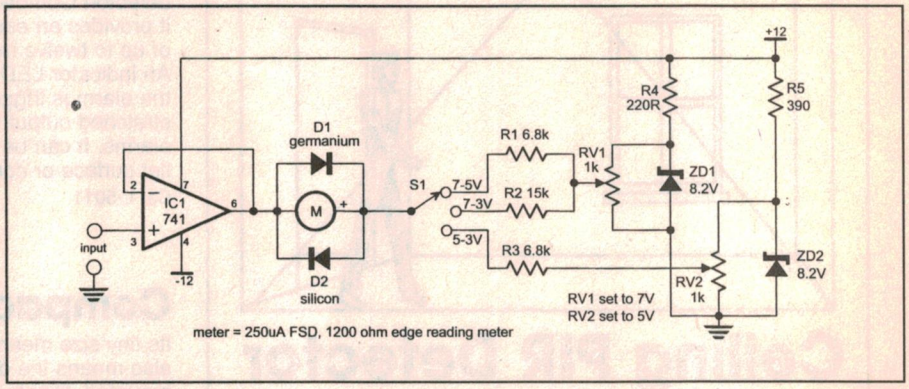
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Expanded scale meter

With the high cost of panel meters, I decided to design a circuit that would allow me to use a cheaper VU edge style meter to measure the AGC voltage of a receiver. This meant designing a circuit to give an expanded scale. For example, a voltage range of 5V to 7V rather than 0 - 7V.

This circuit gives a positive-going reading for a decreasing input voltage, as the AGC voltage decreases with signal strength. Reverse the meter connections to get a positive going reading for an increasing input voltage. For the values shown, the voltage range of the meter is from 7V to 3.4V.

The voltage being measured is applied to pin 2 of IC1, which is connected as a unity gain voltage follower to give the circuit a high input resistance. In some cases, IC1 may not be needed. The Zener diodes and the associated circuitry give the required reference voltages for the meter. Resistors R1, 2 and 3 are multipliers for each of the three ranges. S1 gives range selection and D1 and D2 provide overvoltage protection for the meter movement.



Diode D1 is a germanium type to give protection for a reverse voltage of 0.3V or more. D2 is a silicon diode that gives forward protection for a voltage above 0.6V. The meter movement has an FSD voltage of about 0.3V. For the ranges shown, RV1 is set to give a voltage of 7V at its wiper and RV2 set to 5V. So, if the input voltage is 7V, the potential across the meter circuit is 0V. When S1 is set to the 7-5V range, if the input voltage is 4V, the potential across the meter circuit is now 2V. The total resistance of the meter circuit is the resistance of the meter movement (1.2k) plus the value of R1 (6.8k), giving a total of 8k. The 2V drop across this resistance gives the required FSD current of 250uA.

Obviously the circuit values can be changed to give any voltage range. I've used a similar circuit to measure temperature, again with an edge reading meter.

Darren Cardwell,
Guildford, NSW. **$35**

Variable timer

This circuit was designed for a local restaurant that wanted an audible timer to count a few minutes for measuring the cooking time of various foods. Features of the design include a very simple user interface, timer mode displays along with audible and visual alarm indicators. It uses standard off-the-shelf low power components.

The heart of the timer is a 4060 binary ripple counter. This device has an internal clock oscillator that determines the delay period. The time delay can be set to any value by changing the value of C1 or by adjusting RV1. The values shown on the circuit give a delay from two to six minutes.

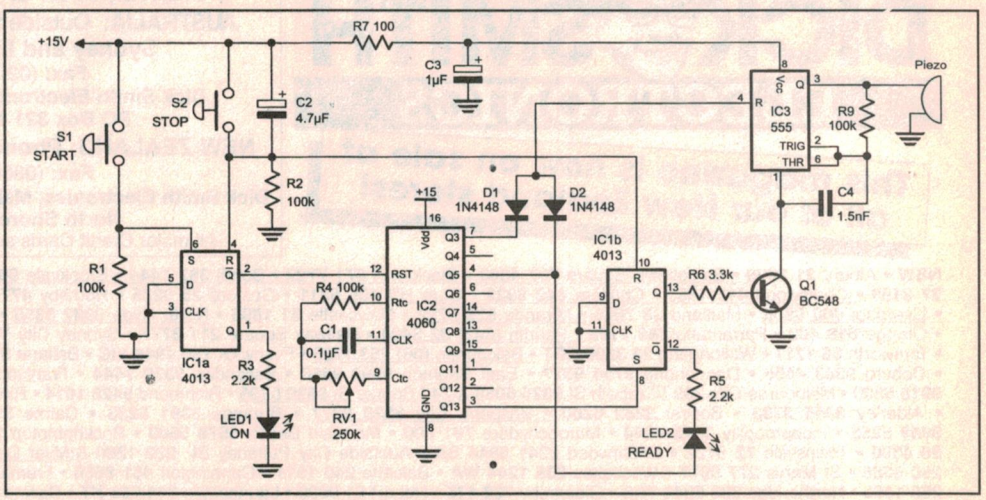
The START button begins the timer, lighting the ON LED. When the time period has ended, the READY LED flashes and an audible beep is produced by the piezo buzzer. The STOP button resets the counter.

In the READY mode, the 555 timer serves as the alarm driver which is modulated by the output of the 4060, through D1 and D2. A different alarm tone pattern can be obtained by any combination of diodes on the outputs of the counter. I chose two consecutive beeps separated by a half second pause. Also, the tone of the alarm can be altered by changing the value of C4.

The supply voltage can be from 12 to 15V DC, and it should be reasonably well regulated to maintain accuracy. The supply voltage to the 555 timer is bypassed via R7 and C3 to isolate possible noise on the supply rail.

When laying out the circuit board, I placed the 555 timer IC well away from the 4060 oscillator components to avoid possible interference.

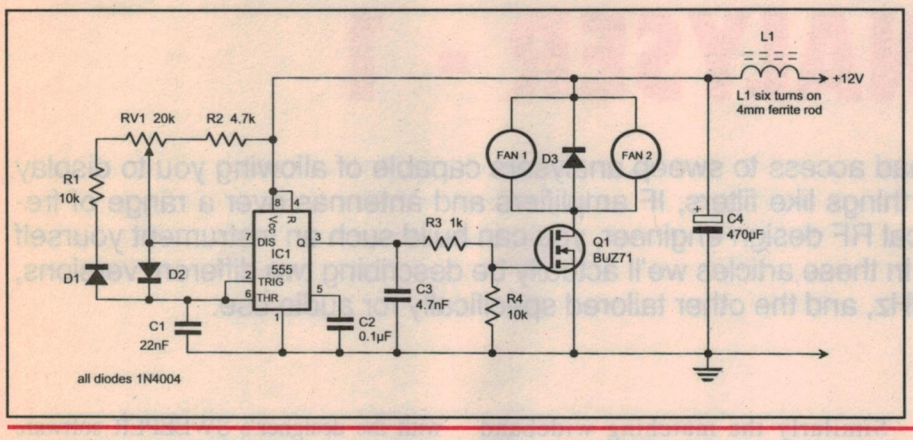
Anton Makotter,
West Croydon, SA. **$40**



Fan speed controller

With a Christmas camping holiday approaching and the promise of a hot summer, I had the need for a fan speed controller capable of working two 12V DC car fans which usually take about 2A each. The design also needed to produce minimal RF interference, as the camp site has poor radio and TV reception.

By experiment I determined that a pulsed frequency of around one to 2kHz produced the least audible noise from the fans themselves. The result was a circuit using the eternal 555 timer, wired as a constant frequency, variable duty cycle driver for a BUZ71 power MOSFET. No heatsink is needed for the MOSFET. The frequency of the output signal at pin 3 of IC1 is determined by the setting of RV1 and the values of R1, R2 and C1. Capacitor C3 removes high frequency components from the output, without a noticeable reduction in the efficiency of the circuit.



I enclosed the circuit board and inductor L1 in a diecast box, which when well earthed gave virtually no RFI to interfere with radio or TV reception. Current drain with both fans at low speed measured an economical 0.8A — about as much as the average car radio at low volume.

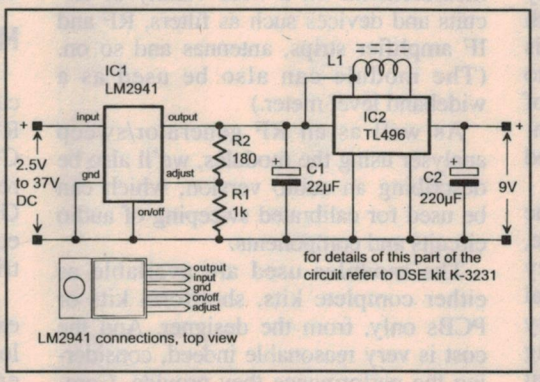
Fred Kemsley,
Bilinga, Qld. **$35**

Solar panel booster

I designed this circuit after receiving a broken 6V solar panel through the mail. After connecting the individual cells together, the array measured 3V open circuit, not enough for my project. However I was determined to make the otherwise useless solar panel pay for itself, and I used this circuit to step up the panel's output to 9V.

The output of the solar panel is fed to an LM2941 1.2 - 37V low dropout regulator, available from DSE (cat no Z-6620). The regulator output is set to 1.5V by R1 and R2, so the input from the panel should be no lower than about 2.5V, at up to 500mA (loaded). Capacitor C1 must be as close as possible to the regulator. Use 1% tolerance resistors for best results. The other part of the circuit is only readily available as a kit (DSE cat no K-3231).

The literature with the kit explains the operation and limitations of IC2 and its associated circuitry. This IC is only about 50% efficient (still very good compared to using a 9V battery), which means for an input of 12mA you get a load current of 1mA. The maximum load current is therefore 40mA.



While the circuit only produces an output when the sun shines, at least it eliminates batteries or having to unplug the AC power supply to use an overcrowded power point for more important things.

Of course, the supply doesn't have to be from solar cells and can be a DC voltage anywhere from 2.5 to 37V DC (at 500 mA or less), as the circuit will produce a regulated output of 9V over this input voltage range.

Barrie Castle,
Bakara RSD. SA. **$30**

Phone ring indicator

This circuit was designed to light a lamp on a radio station console whenever the phone rang, as calls often occur while an announcer is on air. While commercial circuits are readily available, they seem to have a rather short life in this situation, due to the number of calls being received. Therefore a reliable unit able to operate either a 12V or 240V lamp was needed.

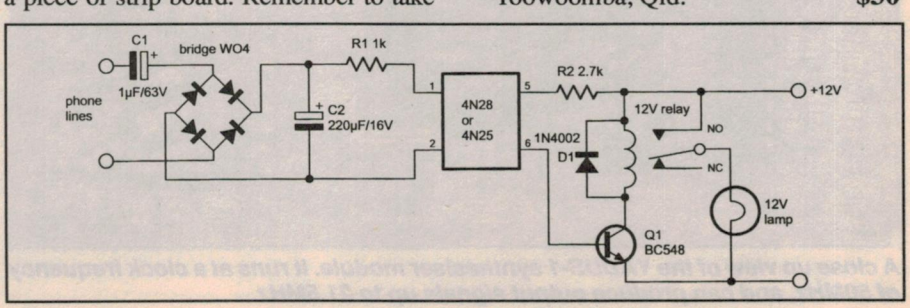
The ring signal is applied to a bridge rectifier, via a 1uF electrolytic capacitor that blocks the DC on the phone line. The DC current from the rectifier drives an opto-coupler (can be either 4N25 or 4N28). Capacitor C2 smoothes the DC and also removes the gap between rings.

Transistor Q1 drives the relay that switches the light. The transistor is biased on by the optocoupler. Although the diagram shows a 12V light, (such as a trailer light), the contacts of the relay (assuming they are appropriately rated) could be used to switch a 240V lamp, or any other device, such as an external bell or siren. If the light stays on all the time, try reversing the phone line connections. Usually the white wire goes to capacitor C1.

I built the prototype into the smallest size zippy box, with all the electronics on a piece of strip board. Remember to take the usual precautions when using the relay to switch 240 volts. Alternatively, a triac could be used to switch a 240 volt light. Simply replace the 4N25/8 with an MOC3021 or similar, therefore eliminating the need for a 12 volt supply.

(Editor's note: This circuit could only be used legally on private telephone lines, i.e., after a PABX, unless approved by Austel.)

David Kilpatrick,
Toowoomba, Qld. **$30**



Using some locally designed modules to make

A PC-CONTROLLED SWEEP ANALYSER - 1

Until now, very few people have had access to sweep analysers capable of allowing you to display and measure the performance of things like filters, IF amplifiers and antennas over a range of frequencies. But now, thanks to a local RF design engineer, you can build such an instrument yourself — for much less than you'd think. In these articles we'll actually be describing two different versions, one for RF applications up to 43MHz, and the other tailored specifically for audio use.

by JIM ROWE

This is the first of a short series of articles describing a family of construction projects with a difference. They're based on a pair of compact, low cost modules which have been designed by an experienced local RF design engineer, and are being sold by him in kit form. The modules interface elegantly with a standard PC, and together with matching software they form the basis of a high-performance and very easy to use sweep oscillator/analyser capable of operating up to over 21MHz on fundamental, or to 43MHz using the added frequency doubler.

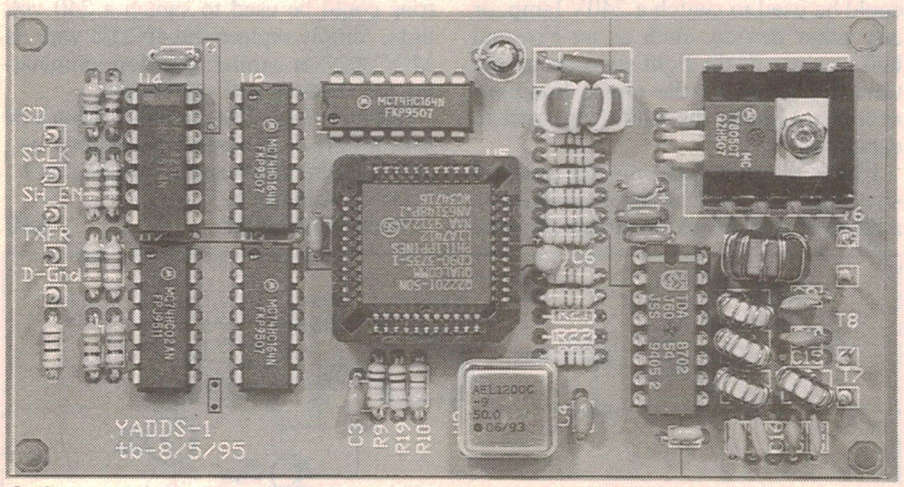
The signal generator module uses the DDS (direct digital synthesis) principle, which means that the output frequency has the accuracy and stability of a crystal oscillator, and is always accurately known. This makes it capable of being used as both a fixed-frequency signal generator and a sweeper, fully programmable in terms of frequency.

Similarly the matching wideband logarithmic detector/ADC module is designed so that its amplitude response is again known, allowing the resulting analyser to be fully calibrated in terms of both frequency and amplitude. This means that it can be used for 'serious' measurements on a wide variety of circuits and devices such as filters, RF and IF amplifier strips, antennas and so on. (The module can also be used as a wideband level meter.)

As well as an RF generator/sweep analyser using the modules, we'll also be describing an audio version, which can be used for calibrated sweeping of audio circuits and components.

The modules used are available as either complete kits, shortform kits or PCBs only, from the designer. And the cost is very reasonable indeed, considering the performance they provide. Complete kits for the modules needed to make the RF sweeper (both modules), complete with the designer's SWEEPER software package, cost only $178.

This means that you should be able to build the complete RF sweep analyser project for less than $270, according to our estimation. An equivalent commercial instrument would cost many thousands of dollars!



A close up view of the YADDS-1 synthesiser module. It runs at a clock frequency of 50MHz, and can produce output signals up to 21.5MHz.

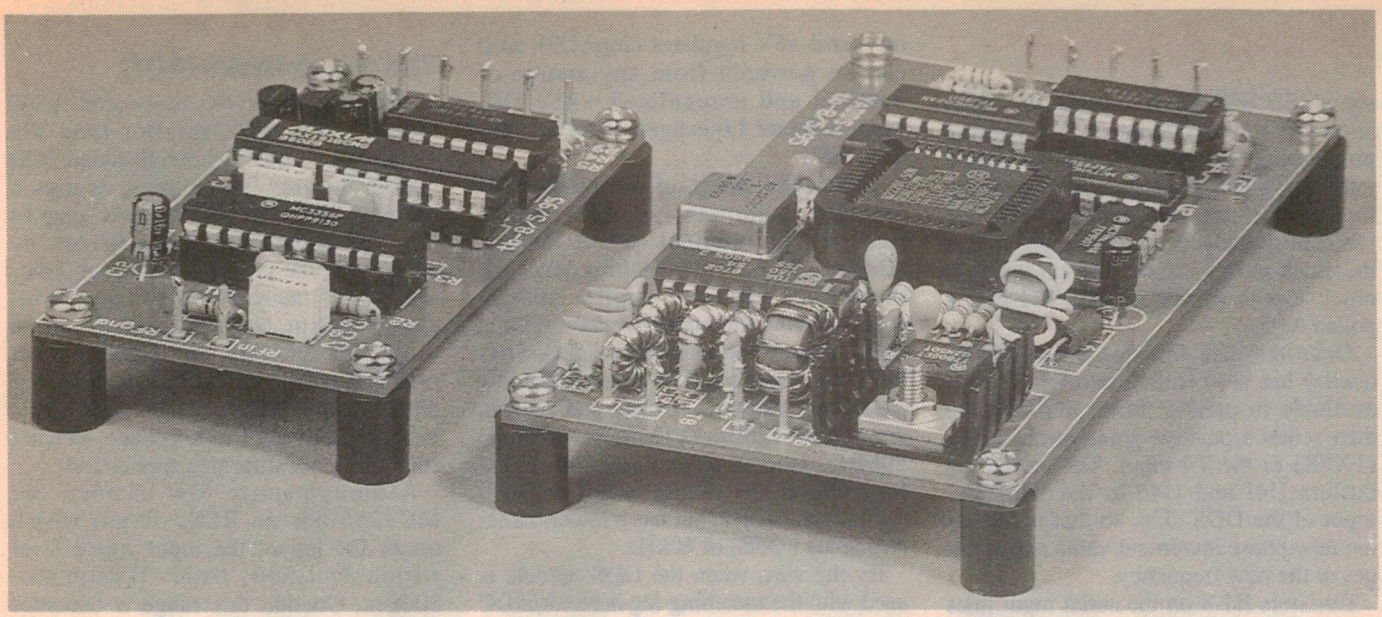
How it happened

It all began when I received a phone call from Tibor Bece, who is a senior RF design engineer with Standard Components, the well-known and respected Australian manufacturer of GME Electrophone two-way radio equipment, as well as Kingray RF distribution systems.

After introducing himself, Mr Bece explained that he'd designed a pair of low cost modules — a DDS signal generator and a wideband logarithmic detector — which interfaced simply with a PC, via a standard printer port. He'd also written some easy to use programs which allowed the DDS module to be used as a calibrated RF or audio signal generator/sweeper, or the two modules together to be used as a sweep analyser. Did I think *EA*'s readers would be interested?

Needless to say I certainly did, and encouraged Tibor Bece to tell me more. And the more I learned about his modules and their potential, the more interested I became.

It turned out that the modules concerned have been designed for great flexibility, and are actually the first two of a planned series, all designed to provide the technician and experimenter with low cost 'building blocks' for making their own PC-based RF and audio instrumentation. All of which



makes them of great potential interest to *EA* readers, I believe.

Soon after our conversation, a small parcel arrived from Mr Bece with an early prototype of an RF sweep analyser using his modules, plus a 'first version' of his driver software. As soon as I tried these out, I was so impressed with their potential that I rang him next morning to confirm that we'd like to present some projects along these lines.

So that's the story behind the projects. Now let's look at the two modules that Tibor Bece has developed, and how they work.

The DDS module

The DDS generator module is built on a small double-side PC board measuring only 110 x 58mm. It uses the same Qualcomm Q2220 DDS chip that was used in the DDS3 kit and DDS3-PC card from US firm Novatech, which we reviewed in the April 1993 and February 1994 issues of *EA*. Tibor Bece has dubbed this module the YADDS- 1, where 'YADDS' stands for 'yet another DDS'; but to my mind he's being far too modest. As you can see from the schematic, it's an elegant design which uses surprisingly few parts to deliver a high level of performance.

The basic DDS section is quite straightforward, with the Q2220 DDS chip (U5) clocked at 50MHz from an eight-pin DIL crystal oscillator (U8). The eight most significant output bits of the Q2220 chip are then used to drive a low cost Philips TDA8702 eight-bit video DAC (U6), to reconstruct the analog output waveform. The balanced 75Ω outputs from the TDA8702 are then coupled to the unbalanced 50Ω low-pass output filter via TR1, a wideband matching transformer wound in bifilar fashion on a small ferrite toroid.

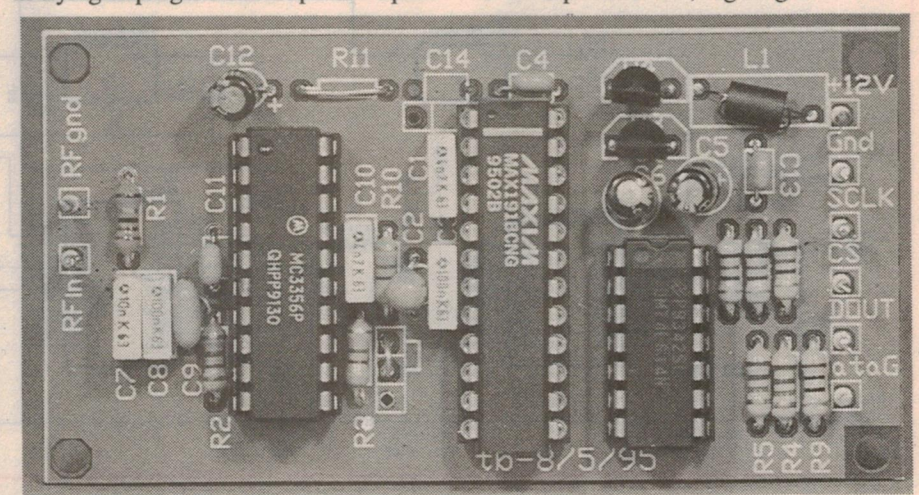
The output filter itself is a ninth-order Chebyshev type, with a corner frequency of 21.5MHz and only 0.03dB of ripple when terminated in a 50Ω load. It uses four easily wound series inductors, on small low-loss iron dust toroids, in conjunction with 5% NPO capacitors.

But it's the computer interface section of the YADDS-1 module that's really elegant, allowing the DDS chip to be controlled from the PC's parallel printer port using a minimum of hardware. This is done by using the printer port not for the usual parallel data transfer, but for software-driven serial data transfer.

To program it for any desired output frequency, the Q2220 DDS chip needs to be fed a 23-bit binary number corresponding to the corresponding phase increment value (the 24th or MSB bit is internally set to a zero, as there's no point in trying to program the chip for frequencies above Fc/2). In this case the 23-bit word is sent out serially by the PC software, via one pin of the printer port, and arrives at pin T1 on the module. It's then fed into series-connected 74HC164 serial in/parallel out registers U1-3, which are used to reassemble it into parallel form for feeding into the DDS chip.

In more detail, the serial data from T1 is fed through buffers U4a and U4b to the serial inputs of U1, and then from the MSB output of U1 to the serial inputs of U2, and finally from the MSB output of U2 to the serial inputs of U3. So U1-3 form what is effectively a 24-bit shift register, although the Q0 output of U1 is not needed or used.

To actually shift the serial data into U1-3, the PC software sends 24 shift clock pulses to the chips via input line T2, labelled 'SCLK'. But since Tibor Bece's printer port interface is designed to 'talk' to multiple modules, a gating or 'enable'



And here's a close up view of the log detector/ADC module. It combines an FM receiver chip (as the log detector) with a 12 bit analog to digital converter.

signal 'SH-EN' is also sent via line T3, to allow the software to control the shifting process and ensure data is only shifted into U1-3 when this is intended. Inverting buffers U4c and U4d and gate U7a are used collectively as an AND gate, so that the clock pulses can only reach the shift clock inputs of U1-3 when SH-EN is pulled high.

Once the data for the new DDS frequency has been shifted into U1-3 and is available in parallel form, the software then sends a positive-going strobe pulse (TXFR) to the T4 input. This is fed via buffers U4f and U4e to the 'HopClk' input of the DDS chip, so that it accepts the new phase increment value and changes to the new frequency.

Resistors R1-8 on the serial input lines are used to ensure correct line termination, and this together with the signal conditioning provided by the Schmitt trigger input buffers ensures that the data transfer process is 'clean' and error free even with a relatively long printer cable. Resistor R20 is used for earth decoupling, to prevent spurious outputs due to leakage of digital information.

The purpose of series coupling resistors R11-18 and R23 is to minimise digital noise transfer into the DAC chip, again to reduce spurious outputs and EMI. Inductor L1 in the +5V line, together with the various supply line bypass capacitors, is used to decouple the supplies for the analog and digital circuitry, for the same purpose. Careful separation of the 'analog' and 'digital' areas on the PCB grounding copper also contributes to the module's low level of spurious output components.

As you can see, the module has its own on-board +5V regulator chip (U9), so it can be powered from any source of nominal and unregulated +12V DC. Input inductor L6 is again used to minimise EMI.

The careful design of this module has resulted in impressive performance figures. The nominal output level is +2dBm (280mV RMS) into 50Ω, although as with any similar system reconstructing an analog waveform via a DAC, there is an inevitable sin(x)/x rolloff. This combined with losses in the low pass filter results in a slow and smooth droop from +2dBm at 1MHz to -2dBm at 20MHz. Due to output coupling transformer TR1 the output is not constant right down to 3Hz, but has a lower corner frequency (-3dB) of 60kHz.

By the way, when the DDS module is used with the matching log detector/ADC module for sweep analysis, the software uses a calibration data file to correct for both the DDS output rolloff and the log detector's frequency characteristic — giving an effectively 'flat' response for the combination.

The spectral purity of the DDS module's output is very good, considering the low cost DAC employed. The main spurious output is the second harmonic of the output frequency, and the exact level depends upon the DAC chip and the actual output frequency; however it is always at least 40dB below the main output, and below about 9MHz, it's usually better than -50dBc.

The only other significant output component is the second harmonic of the sampling alias frequency. This again varies with frequency and the DAC chip, but is generally below -45dBc. All other spurious components are generally below -60dBc.

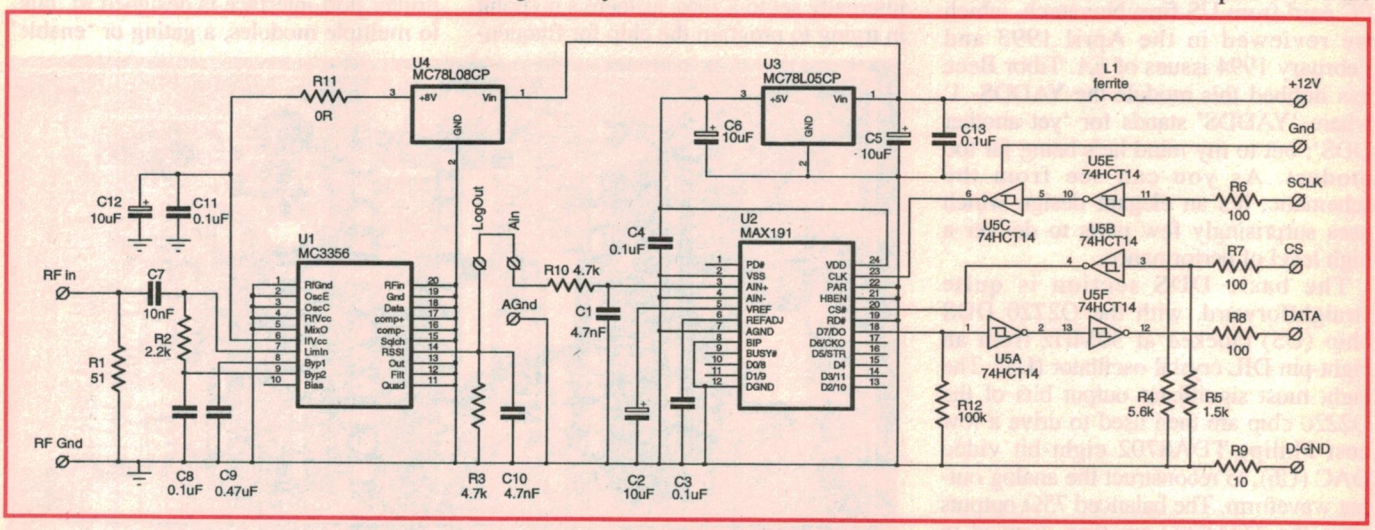
The log detector/ADC

The matching log detector/ADC module is a little smaller than the YADDS-1 module, its double-sided PCB measuring only 76 x 41mm. It uses a Motorola MC3356 'FM receiver' chip as its wideband logarithmic detector, by using only the chip's limiting amplifier and 'RSSI' (received signal strength indicator) output. Normally used to drive a tuning or S-meter, the RSSI output provides a 'DC' current output with a log relationship to the input signal level. This is easily converted to a voltage, making such a chip ideal for this application.

Although quite low in cost, the MC3356 has an RSSI output which tracks the log of the input signal level within +/-1.5dB, from -10dBm to -80dBm. Outside this range it becomes nonlinear, but can be linearised via a software calibration file to cover from -90dBm to 0dBm. The optimum signal input range is from -70dBm to - 10dBm.

The RSSI output is not temperature compensated, and varies up to a couple of dB over the usual ambient temperature range. It also varies with input frequency, dropping approximately 8dB every 10MHz. As this frequency dependence also varies with input level, it can't be corrected easily in hardware; however the software developed by Tibor Bece uses its calibration file to correct for these variations.

Looking now at the schematic for this module, you can see that the RF input is fed to the limiter input (pin 7) of the MC3356 (U1) via coupling capacitor C7, with R1 used to provide a 51Ω input termination. The input pin is also supplied with its correct DC bias via R2, from pin 9. Most of the rest of the pins of U1 are



The schematic for the log detector/ADC module. The output of the MAX191 analog to digital converter is coupled elegantly to the PC via its parallel printer port, but using a simple serial interface.

grounded, apart from the RSSI output on pin 14.

Resistor R3 is used to convert the RSSI output current into a voltage, with C10 used for RF bypassing. The value of R3 thus determines the detector gain, in volts/dBm, and can be adjusted for hardware calibration.

The output from log detector U1 is fed to U2, a Maxim MAX191 12- bit ADC (analog to digital converter) chip. This is used to sample the converted detected signal level voltage, and provide 12-bit binary values for correction, display, measurement and storage by the PC software.

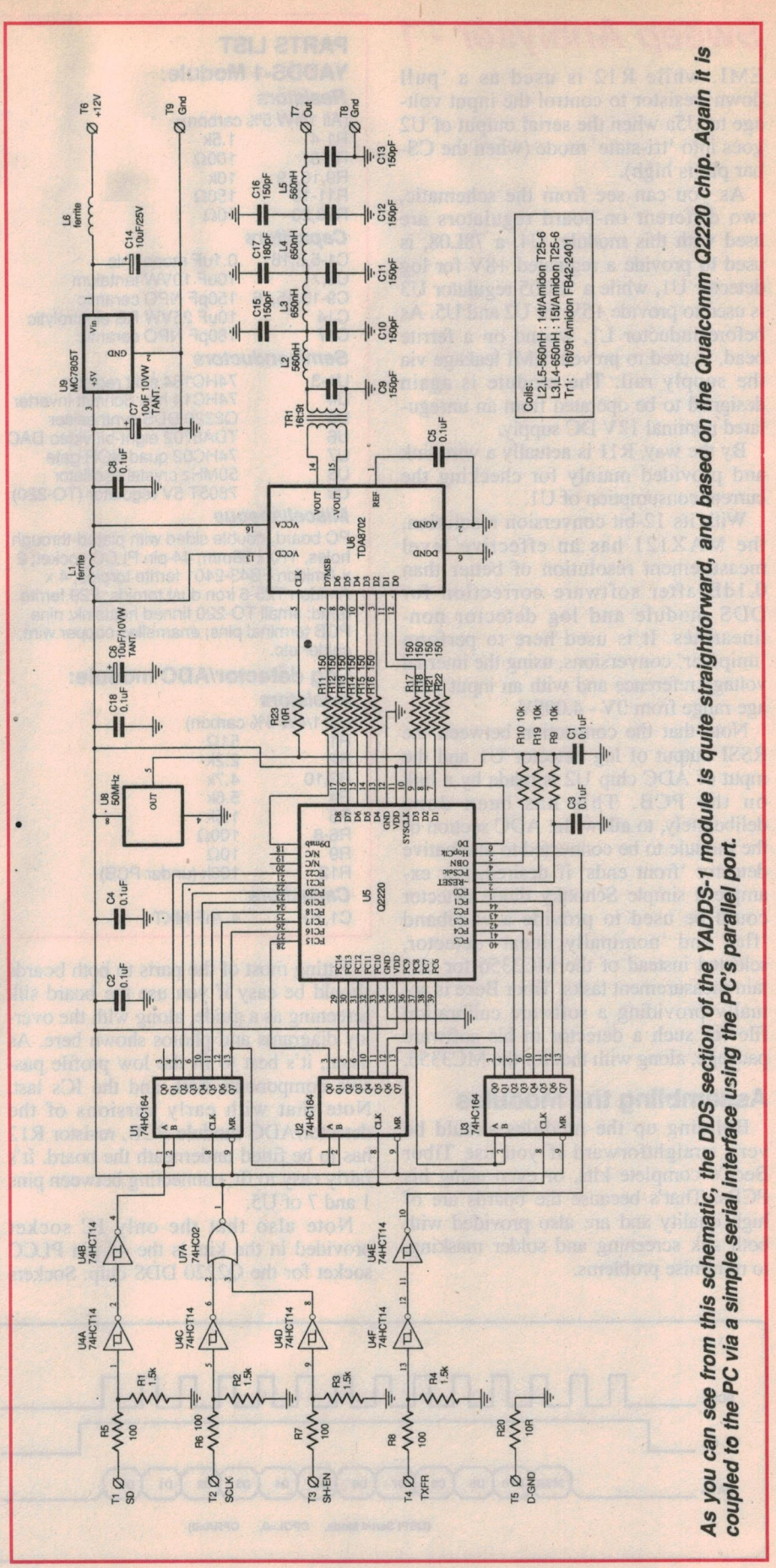
As with the DDS module, a simple and elegant serial interface scheme is used to feed the digitised data back to the PC, via the parallel printer port. In this case things are simplified, because the MAX121 chip can be configured for either a serial or parallel output interface, as required.

Here the PC software shifts out the digital samples by supplying a stream of 12 shift clock pulses on the SCLK line to pin 23 of U2, via buffers U5e and U5c. Since these pulses are sent out on the same printer port line used to clock data into the DDS module, it's again necessary to send a gating or enable signal to ensure that the clock pulses are directed to the correct module. In this case the signal is sent on the CS line, and fed via buffer U5b to pin 20 of U2 — the chip's active-low CS (chip select) line.

The actual 12-bit data samples are shifted out of pin 18 on U2, and are fed out of the module via buffers U5a and U5f, to the DATA pin and hence to one of the 'handshaking' lines of the printer port, to return to the PC.

The CS signal from the PC actually triggers a new A-D conversion cycle of the MAX121, when it goes high (low at pin 20). The fact that we can begin shifting the data bits out of the MAX121 so soon after conversion begins is because this chip is a 'successive approximation' ADC, and it produces the sample bits in rapid succession — starting with the MSB (most significant bit) and ending with the LSB (least significant bit). Since the bits are shifted out of the chip in the same order, almost no time is wasted; conversion and data output take place during the same period. (See timing diagram.)

As before, resistors R4-8 are used to provide correct termination of the printer port lines, and this together with Schmitt buffers U5a-f ensures correct operation even with fairly long printer cables. R9 is used to decouple the digital and analog earths, to minimise earth currents and



As you can see from this schematic, the DDS section of the YADDS-1 module is quite straightforward, and based on the Qualcomm Q2220 chip. Again it is coupled to the PC via a simple serial interface using the PC's parallel port.

Sweep Analyser - 1

EMI, while R12 is used as a 'pull down' resistor to control the input voltage to U5a when the serial output of U2 goes into 'tri-state' mode (when the CS-bar pin is high).

As you can see from the schematic, two different on-board regulators are used with this module. U4, a 78L08, is used to provide a regulated +8V for log detector U1, while a 78L05 regulator U3 is used to provide +5V for U2 and U5. As before inductor L1, wound on a ferrite bead, is used to prevent EMI leakage via the supply rail. The module is again designed to be operated from an unregulated nominal 12V DC supply.

By the way, R11 is actually a wire link and provided mainly for checking the current consumption of U1.

With its 12-bit conversion resolution, the MAX121 has an effective level measurement resolution of better than 0.1dB after software correction for DDS module and log detector non-linearities. It is used here to perform 'unipolar' conversions, using the internal voltage reference and with an input voltage range from 0V - 4.095V.

Note that the connection between the RSSI output of log detector U1 and the input of ADC chip U2 is made by a link on the PCB. This has been done deliberately, to allow the ADC section of the module to be connected to alternative detector 'front ends' if desired. For example a simple Schottky diode detector could be used to provide a wideband 'flat' and 'nominally linear' detector, selected instead of the MC3356 for certain measurement tasks. Tibor Bece is actually providing a software calibration file for such a detector in his software package, along with that for the MC3356.

Assembling the modules

Building up the modules should be very straightforward if you use Tibor Bece's complete kits, or even using his PCBs. That's because the boards are of high quality and are also provided with both silk screening and solder masking, to minimise problems.

PARTS LIST

YADDS-1 Module:

Resistors

(All 1/4W 5% carbon)

R1-4	1.5k
R5-8	100Ω
R9,10,19	10k
R11-18	150Ω
R20,23	10Ω

Capacitors

C1-5,8,18	0.1uF monolithic
C6,7	10uF 10VW tantalum
C9-13,15,16	150pF NPO ceramic
C14	10uF 25VW RB electrolytic
C17	180pF NPO ceramic

Semiconductors

U1-3	74HC164 shift register
U4	74HC14 hex Schmitt inverter
U5	Q2220 DDS synthesiser
U6	TDA8702 eight-bit video DAC
U7	74HC02 quad NOR gate
U8	50MHz crystal oscillator
U9	7805T 5V regulator (TO-220)

Miscellaneous

PC board, double sided with plated-through holes, 110 x 58mm; 44-pin PLCC socket; 2 x Amidon FB43-2401 ferrite toroids; 4 x Amidon T25-6 iron dust toroids; F29 ferrite bead; small TO-220 finned heatsink; nine PCB terminal pins; enamelled copper wire, solder etc.

Log detector/ADC module:

Resistors

(All 1/4W 5% carbon)

R1	51Ω
R2	2.2k
R3,10	4.7k
R4	5.6k
R5	1.5k
R6-8	100Ω
R9	10Ω
R12	100k (under PCB)

Capacitors

C1,10	4.7nF MKT
C2	10uF 16VW tantalum
C3	0.1uF MKT
C4,8,11,13	0.1uF monolithic
C5,6,12	10uF 25VW RB electrolytic
C7	10nF MKT
C9	0.47uF monolithic

Semiconductors

U1	MC3356 FM receiver
U2	MAX191 12-bit ADC
U3	78L05 +5V regulator
U4	78L08 +8V regulator
U5	74HC14 hex Schmitt inverter

Miscellaneous

PCB, double sided with plated through holes, 76 x 41mm; eight PCB terminal pins; F29 ferrite bead; enamelled copper wire, solder, etc.

Note that complete kits for these modules are available from the designer, Tibor Bece, of PO Box 1379, Sunnybank Hills, Queensland 4109. The complete kits also include driver software programs, and are priced as below:

YADDS-1 Module.....	**$99.00**
Log detector/ADC module.....	**$69.00**

Mr Bece can also supply 'short form' kits for each module, if desired, and/or the PC boards alone. The short form kits basically only include the integrated circuits, but that for the YADDS-1 module also includes the PLLC socket and the 50MHz oscillator. The prices are as below:

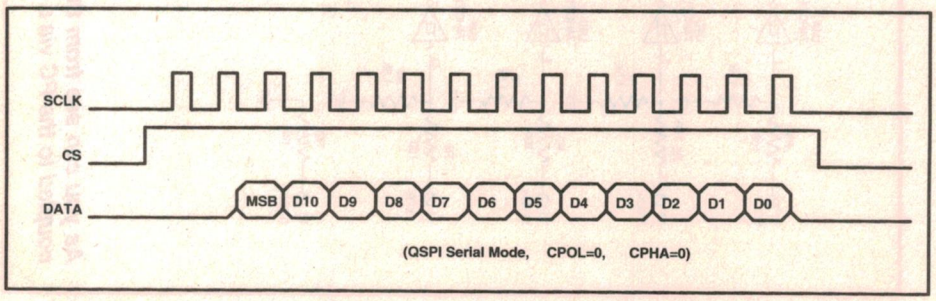
YADDS-1 short form kit.....	**$70.00**
YADDS-1 PCB only.....	**$25.00**
Log det/ADC short form kits....	**$45.00**
Log det/ADC PCB only.....	**$20.00**

In addition to the driver software included with the full module kits, Mr Bece can also supply a software package to facilitate using the modules together as a sweep analyser. The SWEEPER software package is priced at $39 if purchased separately, or only $10 if purchased together with the two complete module kits.

Fitting most of the parts to both boards should be easy if you use the board silk screening as a guide, along with the overlay diagrams and photos shown here. As usual, it's best to fit the low profile passive components first, and the ICs last. Note that with early versions of the detector/ADC module PCB, resistor R12 has to be fitted underneath the board. It's fairly easy to fit, connecting between pins 1 and 7 of U5.

Note also that the only IC socket provided in the kits is the 44-pin PLCC socket for the Q2220 DDS chip. Sockets are optional for most of the other chips, and can be used if you wish — *except* for the MC3356 log detector chip on the ADC module. This should be soldered directly into the PCB, for correct operation. But if you do elect to use sockets for the other chips, don't use cheap ones of poor quality; it would be better not to use sockets at all.

Probably the only other components that need much discussion are the various inductors, and matching transformer TR1 on the YADDS-1 module. Most of these are wound quite easily on small ferrite or



This timing diagram shows how the MAX191 analog to digital converter chip can be arranged to output its conversion data serially, during the actual conversion process. This is possible as it's a successive-approximation converter.

How Direct Digital Synthesis works

For those who are not familiar with the operation of a DDS as yet, we explained the basic principles in some depth in the April 1993 article 'How A DDS Works' — which also described the operation of the Qualcomm Q2220 chip. However to save you having to look up that issue, here's a brief summary.

Essentially, a DDS generates a sinewave signal by feeding a DAC (digital to analog converter) with a stream of digital waveform samples, read out cyclically from a sequence stored in ROM (read-only memory). However instead of using a simple binary counter to increment the ROM address by one, before fetching each sample, the DDS uses a binary adder and accumulator register combination — which allows it to increment the ROM address by any desired integer. And as this 'phase incrementing value' is programmable, this allows the output frequency to be varied in precise fashion despite the use of a single, fixed master clock frequency (usually a crystal oscillator).

The minimum output frequency of the DDS, which also corresponds to the smallest programmable change we can make in its output frequency, is equal to the master clock frequency divided by the addressing range of the adder/accumulator 'phase accumulator' register:

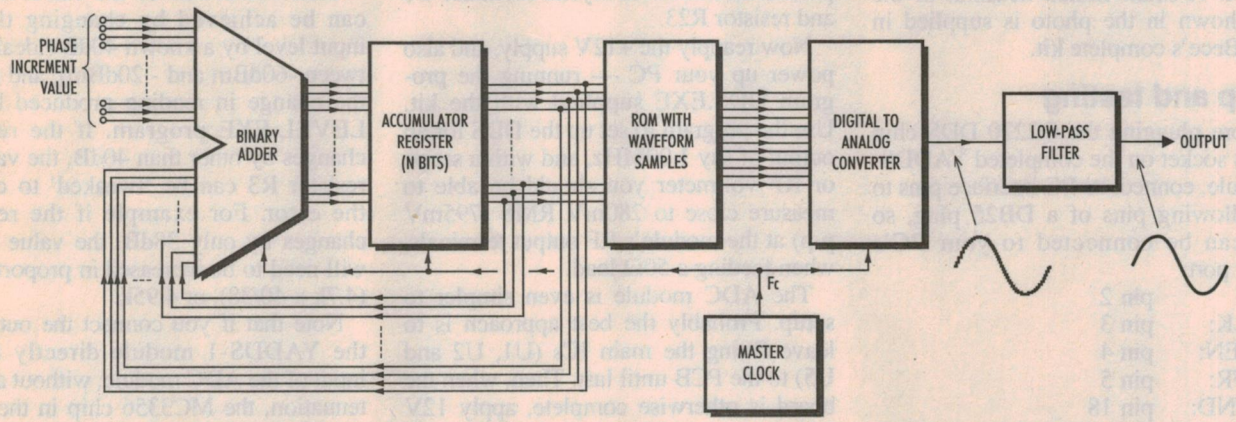
$Fmin = Fc/2^N$

Where Fc is the fixed clock frequency and N is the number of bits in the phase accumulator. Hence in the case of the Qualcomm Q2220 chip, which has a 24-bit phase accumulator, the minimum output frequency/smallest frequency change is $Fc/2^{24}$, or Fc divided by 16,777,216. If we use a clock frequency of 16.777216MHz, for example, we get a minimum output frequency of 1Hz and we can change it in 1Hz increments. Doubling the clock frequency gives a minimum frequency and incrementing value of 2Hz.

For the RF version of his YADDS-1 module, Tibor Bece has used a 50MHz crystal clock to drive the Q2220. This gives a minimum output frequency and incrementing value of 2.98Hz. The matching software is used to program the DDS with the corresponding phase increment values to achieve any desired output frequency (or strictly, the nearest multiple of 2.98Hz).

As with any digital sampling system, the maximum output of a DDS is limited to half the clock frequency, and also contains signal components associated with the clock frequency. To remove these components and achieve a smooth 'clean' output, the stepped signal from the DAC must therefore be passed through an 'anti-aliasing' sharp cutoff low-pass filter. Generally the corner frequency of the filter is set at about 40% of the clock frequency, and this becomes the highest useable output frequency from the DDS.

With the RF version of the YADDS-1 module, the filter corner frequency is set to around 21.5MHz.



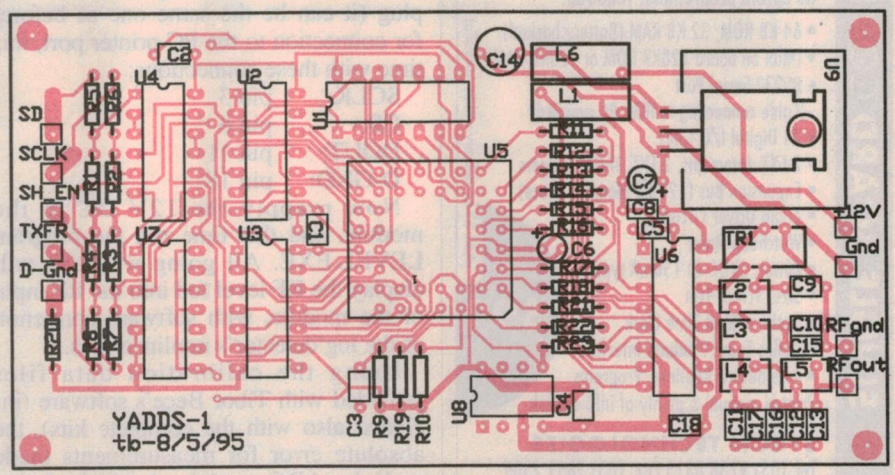
iron dust toroids, apart from L1 on the ADC module and L6 on the YADDS-1 module, which are both wound on small ferrite beads. All are very light, and attached to the PCBs via the ends of their winding wires. The necessary toroids and beads are supplied in Tibor Bece's complete kits.

The trickiest item is TR1, which is wound on an Amidon FB42-2401 ferrite toroid using 0.224mm enamelled copper wire. Both windings are wound together in bifilar fashion, by lightly twisting the two lengths of the wire together before winding them on the toroid. The catch here is that although the primary winding is of 16 turns, the secondary has only nine. This is achieved by carefully winding nine turns with the two twisted wires, spreading them evenly around the toroid (over about three-quarters of the circumference). Then separate the remaining lengths of the wires, and cut *one* off about 8mm from the end of the last wound turn. This will be the 'earthy' end of the secondary. Then wind a further seven turns with the remaining long wire, to provide the rest of the primary winding.

After finishing, separate the two start ends, and identify which is which by checking with a multimeter or continuity checker. Then cut all remaining long ends about 8mm from the windings, scrape back the enamel and tin the ends ready to fit the transformer to the PCB.

The DDS output filter inductors L2-L5 are all wound on Amidon T25-6 low loss iron dust toroids, using 0.4mm enamelled copper wire. L2 and L5 have 14 turns, spread evenly around most of their circumference, while L3 and L4 have 15 turns wound in the same way.

Supply line decoupling inductor L1 on the YADDS-1 module is wound on another Amidon FB42-2401 ferrite toroid, but this time using light-gauge



Use this overlay diagram as a guide when wiring up the YADDS-1 generator module. The text explains how to wind transformer TR1 and the inductors.

PVC insulated hookup wire (such as wire-wrap wire). Seven turns are used, spread around about 3/4 of the circumference.

EMI suppressor choke L6 on the YADDS-1 module is simply a straight wire link, passing through an F29 ferrite bead. The corresponding choke L1 on the ADC module consists one full turn of 0.224mm enamelled copper wire, on another F29 bead.

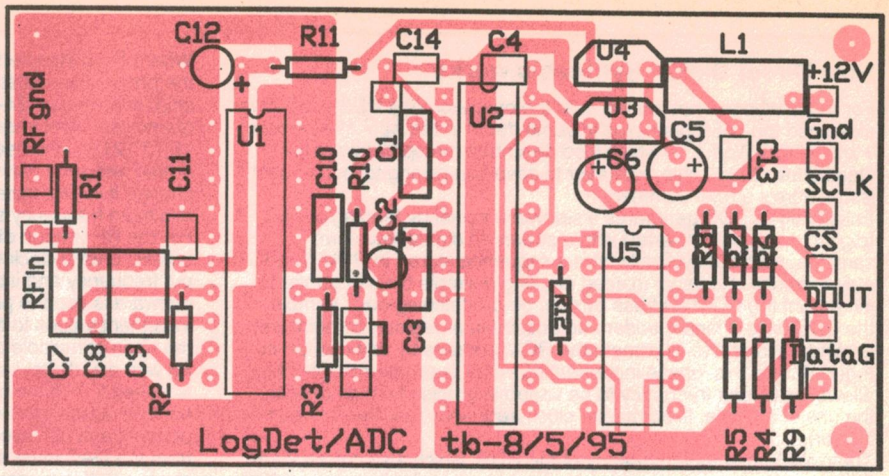
Note that PCB pins are recommended for all off-board connections to the modules, and pins are supplied in the complete kits. Note also that the TO-220 5V regulator chip on the YADDS-1 module needs a small heatsink, as the current drain of this module is about 150mA. A small finned heatsink of the type shown in the photo is supplied in Tibor Bece's complete kit.

Setup and testing

Before plugging the Q2220 DDS chip into its socket on the completed YADDS-1 module, connect its PC interface pins to the following pins of a DB25 plug, so they can be connected to your PC's printer port:

SD:	pin 2
SCLK:	pin 3
SH-EN:	pin 4
TXFR:	pin 5
D-GND:	pin 18

Now apply 12V DC to the module's supply pins, and use your DMM to check that the +5V rail from regulator U9 is correct. If all seems well, remove the power and plug U5 carefully into its socket. Note that its 'chamfered' corner is positioned nearest to crystal oscillator U8 and resistor R23.



Here's the overlay diagram for the log detector/ADC module, too. Note that the link next to resistor R3 can be removed, to allow the use of an alternative detector circuit with the analog to digital converter.

Now reapply the +12V supply, and also power up your PC — running the program DDS.EXE supplied with the kit. Use the program to set up the DDS for an output of say 1.00MHz, and with a scope or RF voltmeter you should be able to measure close to 280mV RMS (795mV p-p) at the module's RF output terminals, when feeding a 50Ω load.

The ADC module is even simpler to setup. Probably the best approach is to leave fitting the main ICs (U1, U2 and U5) to the PCB until last. Then, when the board is otherwise complete, apply 12V DC to the power pins and check with your DMM to make sure that the +5V and +8V rails are correct. If not, this will almost certainly be because you have fitted one of the regulator chips wrongly — and you'll have a chance to correct the error before any damage is done.

If all seems well, you can remove the 12V supply and fit the remaining ICs, to complete assembly. Then connect the module's PC interface pins to a DB25 plug (it can be the same one as before) for connection to the PC printer port, this time with these connections:

SCLK:	pin 3
CS:	pin 6
DOUT:	pin 11
D-GND:	pin 18

Now reapply the 12V DC to the module, and this time run the program LEVEL.EXE. All going well this will display the RF level fed into the RF input of the module, with software correction of the log detector's nonlinearities.

Using the calibration data files provided with Tibor Bece's software (included also with the complete kits), the absolute error for measurements made with the ADC module should be better than +/-3dB.

Gain correction of the ADC module can be achieved by changing the RF input level by a known 40dB (ideally between -60dBm and - 20dBm), and noting the change in reading produced by the LEVEL.EXE program. If the reading changes by other than 40dB, the value of resistor R3 can be 'tweaked' to correct the error. For example if the reading changes by only 38dB, the value of R3 will need to be increased in proportion to (4.7k x 40/38), or 4.95k.

Note that if you connect the output of the YADDS-1 module directly to the input of the ADC module, without any attenuation, the MC3356 chip in the latter will be overdriven by the excessive input level and will not operate correctly. So you'll need a suitable attenuator if you want to use the DDS module as your signal source. (A suitable attenuator is described in the second of these articles.)

By the way, for those who elect not to buy complete kits or the full matching software from Tibor Bece, he has developed some simple 'to get you going' driver programs which he's allowing us to make available freely, either by downloading from our BBS or by sending in a formatted floppy disk for a copy of the files via our Reader Information Service ($5.00 nominal charge for our copying time and postage).

There's one driver program for the YADDS-1 module and another for the detector/ADC module, and both are being provided in both C source code and EXE forms.

That completes the present article, describing the basic modules developed by Tibor Bece. In the second of these articles, we'll present construction details for the RF version of a high performance signal generator/sweep analyser using the modules.

(To be continued.) ❖

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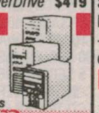

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RITRON COMPUTER SYSTEMS NOW WITH 420 MB H.D.D.

CPU TYPE	GREAT VALUE!!	TAX EX.	TAX INC
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486DX2-80		$1125	$1372
486DX4-100		$1199	$1462
Pentium™ 60*		$1350	$1639
Pentium™ 75*		$1595	$1945
Pentium™ 90*		$1720	$2098
Pentium™ 100*		$1890	$2299
Pentium™ 120		$2375	$2899
Pentium™ 133		$2775	$3385

*External 256K Cache

4 YEAR PARTS & LABOUR WARRANTY

All systems include: 4 MEG RAM•420 MEG H.D.D.-GREAT VALUE!!•1.44 MEG 3.5 Floppy Disk Drive•Mini or Baby AT casing•2 SPG Ports•101 Keyboard•3 Slots VESA Local Bus Motherboard•14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor•VLB IMB VGA Cards are supplied in 486 machines AT NO EXTRA COST (Up to 1280 x 1024) Pentium systems now come with PCI Cards and should be bought with 8MB of RAM

DISCOUNTED SOFTWARE

DOS 6.22	*$89
M.S WORKS	*$99
DOS 6.22 & Win 3.11	*$139
DOS 6.22 & Windows for Workgroups	*$159
MS Office Pro	*$795
Windows* 95 OEM 3.5 disk or CD.	*$179

*When purchased with a system only.

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RED HOT SPECIAL!!

256 grey scales hand held scanner. 800 dpi resolution. Users manual included plus driver software.

ONLY $139

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UPGRADES & PERIPHERALS FOR YOUR SYSTEMS

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PENTIUM™ 60MHz/256 C VESA/PCI	$549
PENTIUM™ 75MHz®/256 C PCI/ISA *NEW!*	$799
PENTIUM™ 90MHz® PCI/ISA	$849
PENTIUM™ 100MHz® PCI/ISA	$1099
PENTIUM™ 120MHz® PCI/ISA	$1599
PENTIUM™ 133MHz® PCI/ISA	$2195

*AMD CPU. #CYRIX CPU Without Asterisk- INTEL CPU @ Come with I/O Card fitted on motherboard

MEMORY

30 PIN SIMM	1-9	25+	100+
1M x 9-70 With Parity	$69	$68	$65
4M x 8-70 No Parity	$239	$228	$224
4M x 9-70 With Parity	$249	$245	$239
72 PIN SIMM FOR PENTIUM™ Processor M.B.			
4M X 8-70 No Parity	$249	$239	$229
4M X 9-70 With Parity	$259	$249	$239
8M X 9-70 No Parity	$489	$445	$419
16M X 8-70 No Parity	$889	$839	
16M X 9-70 With Parity	$899	$879	

HARD DRIVES *VOICE COIL IDE HD*

Cap	Av.Access	Tax Inc.	Tax Ex.
212M	16ms	$267	$220
260M	16ms	$242	$200
420M	12ms	$280	$230
540M	12ms	$299	$247
640M	12ms	$364	$299
850M	10ms	$423	$350
1.08GB	10ms	$514	$420
1.27GB	10ms	$629	$520
1.6GB	10ms	$1128	$925
1 *GB SCSI HD*	10ms	$780	$650
2.15*GB SCSI HD*	10ms	$1815	$1500

ALL DRIVES HAVE 3 YEAR WARRANTY HARD DRIVE BRACKET.....$4.95

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1.44MB F.D.D.. *$55.00*
1.2MB F.D.D.... $89.00

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All these superb monitors on display at our store

- **14" Interlaced** 1024x768 (0.28mm Dot pitch) $349
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- **15" XGA Digital MPRII** 1280x1024 .... $629
- **#17" XGA Digital MPRII** 1280x1024 .... $1039
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- ***NEW!!* 20" XGA Digital MPRII** $1899

#15" & 17" Digital Monitor comes with Economy Management Software

CD ROM DRIVES

DUAL-SPEED CD ROM DRIVE
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NEW PANASONIC IDE Interface ***QUAD-SPEED*** CD ROM Drive $299

CREATIVE SB MULTIMEDIA PACKS

SB DISCOVERY 210 KIT *with Double-Speed CD-ROM Drive, SBS30 Stereo Speakers, 12 CD titles* **$329**

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SB HOMEDIA 420 KIT *with Quad-Speed CD-ROM Drive, SBS37 Stereo Speakers, 24 CD titles* **$749**

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PRICES ARE PER BOX OF TEN DISKS

All disks come with Write Protects and envelopes and a life time warranty.

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.50	$4.50	$4.30	$3.95
5¼ DS/HD	$7.95	$7.75	$7.50	$6.90	$6.90
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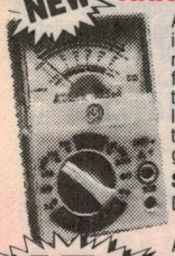
MASSIVE SAVINGS ON ITEMS THAT YOU SHOULD INCLUDE IN YOUR TOOL BOX!! COME TO RIE FOR THE BEST BARGAINS!

NEW ANALOGUE MULTIMETER



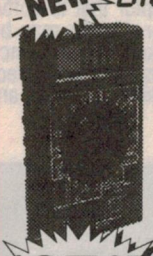
A pocket sized multimeter that includes 5 functions and 16 measuring ranges. Single knob function control makes it very simple to use. Comes complete with test leads and instructions and is ideal for the handyman - can be kept in the glove box of the car.

SPECIFICATIONS

DC Voltage: 0-2.5-10-50-250-500 volts
AC Voltage: 0-10-50-250-500 volts
DC Current: 0-500µA-10mA-250mA
Resistance: Rx10, Rxl k (centre 3.6)
Battery Test: 1.5V 9V
Sensitivity: 2k ohms/volt DC/AC
Power: Requires 1 x AA battery

$17.95
Q13060

NEW DIGITAL MULTIMETER



The ideal meter for technicians with a full 3½ digit LCD readout. Requires a 9V battery either alkaline or carbon. Expected life of carbon battery is 100 hours and 200 for the alkaline.

SPECIFICATIONS

DC Voltage: 200mV-2-20-200-1000 volts
AC Voltage: 200-750 volts
DC Current: 200µA-2000µA-20mA-200m A-10A
Resistance: 200Ω-2000Ω-20kΩ-200kΩ 2000kΩ
Diode Test: Measures forward resistance in kΩ with a test current of 1.5mA max
Power: Requires 1x 9V battery

$37.95
Q13070

DIGITAL MULTIMETER

The ideal meter for technicians with a full 3½ digit LCD readout. Requires a 9V battery either alkaline or carbon. Expected life of carbon battery is 100 hours and 200 for the alkaline.

SPECIFICATIONS

DC Voltage: 200mV-2-20-200-1000 volts
AC Voltage: 200-2-20-750 volts
DC Current: 200µA-2mA-20mA-200mA-2A-20A
AC Current: 200µA-2mA-20mA-200mA-2A-20A
Resistance: 200Ω-2kΩ-20kΩ-200kΩ-2MΩ-20MΩ
Diode Test: Measures forward resistance in kΩ with a test current of 1.5mA max
Power: Requires 1 x 9V battery

$59.95
Q13080

ARLEC STEPDOWN TRANSFORMERS

Stepdown Transformers are designed to allow appliances designed for 110V to 120V to be operated from 240V mains

FEATURES:

- Protective earth carried through to output
- Earthed 3 pin output socket
- Replaceable fuse for overload protection
- Carry handles
- Safe robust construction

$185.95
M21073

MODEL 2166-ST 250 WATT
INPUT 240V 50Hz OUTPUT 115V AC 250VA

$98.95
M21071

MODEL 2164-ST 100 WATT
INPUT 240V 50Hz OUTPUT 115V AC 100VA

BUDGET 30 WATT SOLDERING IRON

Budget-priced soldering iron.Features include:

- Super quick heat up & recovery times.
- 30 watt power.
- Lightweight design for high work rate & productivity.
- Long tip life - replaceable.
- Maximum temperature 330 degree Celcuis.

This soldering iron plugs into any 240VAC/50Hz mains socket to operate.

T12696
$16.95

TIP REPLACEMENT
T12698.....**$9.95**

PENTIUM™ COMPUTER FAN

Suit 90MHz cpus

H10612.
$29.95

PENTIUM™ COMPUTER FAN

For 60/66MHz cpus

H10613
$29.95

NEW BNC PANEL MOUNTING PLATE

These plates have the BNC punched holes made out of plastic

BNC WALL PLATE SINGLE
$5.00
Y16084

BNC WALL PLATE DOUBLE
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COMPUTER FAN

The easy way to cool your CPU

GREAT PRICE!!

H10611
$14.95

SOLDER ROLLS

Don't be fooled by cheap imports. Solder has to have the correct flux or else your soldering iron tip will corrode.

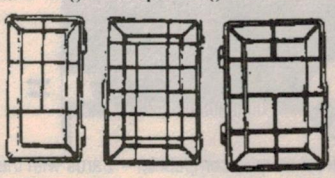
	WAS	NOW
60/40 RESIN CORED:		
0.71MM, 250Grams T31000	$8.95	$7.95
0.71MM, 500Grams T31002	$15.95	$13.95
0.91MM, 250Grams T31010	$7.95	$6.95
0.91MM, 500Grams T31012	$14.95	$12.95
1.6MM, 250Grams T31020	$7.50	$6.05
1.6MM, 500Grams T31022	$15.95	$12.95

HOBBY PACKS- 60/40 Resin cored in 1 metre lengths

0.71MM T31030	$1.50
0.91MM T31032	$1.25
1.6MM T31034	$1.00

HANDY COMPONENTS HOLDERS

Use these handy compartmentated boxes to store all your bits and pieces of electronic components, parts and other stuffs for easy access. Each one is made of robust opaque plastic and have hinged "snaplocking" lid.



FIVE COMPARTMENT PART BOX
One large and four small individual sections. 172W x 90D x 38H mm
H10088 ..... **$5.95**

SEVEN COMPARTMENT PART BOX
One large and six small individual sections. 180W x 118D x 42H mm
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SEVENTEEN COMPARTMENT PART BOX
One large and sixteen small individual sections. 270W x 173D x 40H mm
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Twenty-six storage sections. 274W x180D X 43H mm
H10092 ..... **$11.95**

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SOLDER STATION

A new red-hot item. Perfect addition for the electronic workshop.

RED-HOT SPECIAL

Solder Station plugs into any 240VAC/ 50Hz mains socket to operate. The soldering iron functions at 12-18VAC 6W.

Features include: ● Heating temperature of up to 319 degrees Celsius. ● PTC (Positive Temperature Co-efficient)controlled to maintain consistent tip temperature. ● Fast warmup time. ● Heating temperature of up to 319 degrees Celsius. ● Longer Tip Life.

T12566 ~~$54.95~~
Save $25 **-$29.95**

Stock/Tip replacement-
T12697..... **$9.95**

IT'S TIME TO UPGRADE!

These motherboards are economical, yet solid performers.

80486 DEEP GREEN MAINBOARD

X18400
$179

Advanced features of the 80486 Deep Green mainboard include: ***CPU:*** • Supports CPUs running at 25 / 33 /40 / 50 / 66 / 75 / 80 / 1 100- MHz: • Intel P24T, P24D, 80486DX4 (P24C), 80486DX2 / DX / SX - SL • Cyrix CX486DX2 / DX / S • AMD AM486DX4 / DX2 / DX • UMC U5. ***DRAM Memory:*** **• 2 x 72 pin SIMM socket • 4 x 30 pin SIMM sockets** • Four banks of DRAM with memory size to 64 MB using combinations of 256K, 1M, 2M, 4M, 8M, 16M, 32M, 64M SIMM.

SPECIALS- WITH CYRIX 486DX2-66 CPU....$279

Cache Memory: • L1 write back or write through cache • 0K functional L2 cache • ***I/O Bus Slots:*** • Seven 16 bit I/O slots including three 32-bit VL-Bus master slots • On-board CR2032 3.0 Volt lithium battery • 237-pin ZIF socket. ***BIOS*** • Provides flash ROM support • Supports 3.3 / 4.0 Volts for low voltage CPU.

3 MONTH WARRANTY.

Note that this board obtains its 256k cache memory from the dynamic memory not from the cache onboard (This is not real cache but only **empty chips**).

OPTi895 GREEN PC MAINBOARD

X18409
$209

SPECIALS- WITH CYRIX 486DX2-66 CPU....$309

OPTi 895 GREEN PC MB provides a highly integrated solution for fully compatible, high performance PGAT platform. It supports Intel's 80486DX4/DX2/ DX/SX/SL, Enhanced CPU , P24D, AMD486 & Cyrix microprocessor.

Features: ***CPU*** • Intel 804865X/DX/DX2/SL-Series • Intel P24C (DX4) • AMD Am4B6DX/DX2/DX4 • Cyrix Cx4B6DX/DX2(M7). ***System Clock:*** • Use system clockchip generator IMI46B, CPU operating frequency 8-IOOMHz. ***DRAM Memory:*** • **4 x 72 pin SIMM socket** • Support 2 banks of 72pin and 1 bank of 30pinSIMM module • Support 1MB to 64MB DRAM memory on board ***Cache Memory:*** • Support 128KB, 256KB or 512KB Secondary. Cache memory on board. ***I/O Bus Slots:*** • 32-bit VL-Bus Slot x 3 (support two Bus Master) • 16-bit ISA Slot x 6 • 8-bit ISA Slot x 1. ***BIOS:*** • Licensed Advanced AMI Win.BIOS, Support Flash ROM BIOS.

12 MONTH WARRANTY.

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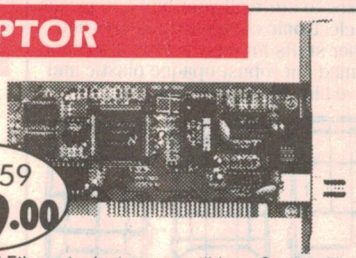
FULL SUPPORT FOR 10 BASE-2 (COAXIAL BNC) AND 10 BASE-T (TWISTED PAIR RJ45). FULL SUPPORT FOR STANDARD NETWORK OPERATING SYSTEMS.



X18159
$119.00

• The 16-bit card is Novell NE2000 Ethernet adaptor compatible. • Cards with the 10BASE-T interface have four diagostic LEDs • The 16-bit card provides 16KB of buffer RAM • All cards provide selectable interrupts and a base I/O address for greater flexibility and compatibility with other add-on cards.

BNC CONNECTORS

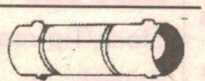
DOUBLE BNC FEMALE

P10501 — 1-9 $4.25 — 10+ $3.50

BNC "T" ADAPTOR 2 Female to Male

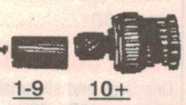
P10505 — 1-9 $5.25 — 10+ $4.50

BNC JOINER



P10513 — 1-9 $3.50 — 10+ $2.95

BNC CRIMP RG58 50 OHM MALE

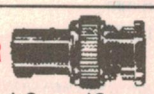


P10523 — 1-9 $2.50 — 10+ $2.25

BNC JACK BNC PLUG "L" TYPE

P10526 — 1-9 $5.95 — 10+ $4.95

BNC TERMINATOR 50 OHM ETHERNET



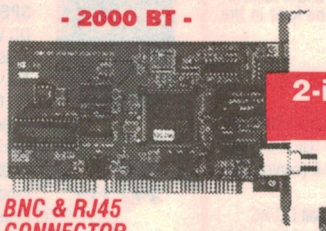
P10527 — 1-9 $3.50 — 10+ $2.95

NIC - 2000 SERIES NETWORKING CARDS

The NIC 2000 networking card is a high performance Ethernet network adaptor that is software configurable. Software configurable means your adapter may be configured by software using the installation diskette. It also includes 16KB of buffer RAM for faster network transmission and reception.

• NetWare Tested and Approved

- 2000 BT -

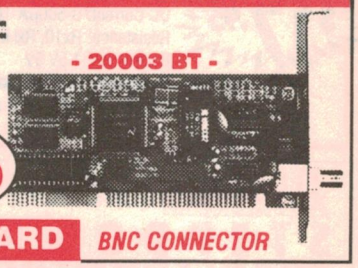


X18165
$79.00

2-in-1 (BNC and RJ45) ETHERNET CARD

BNC & RJ45 CONNECTOR

- 20003 BT -

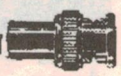


X18161
$69.00

BNC ETHERNET CARD

BNC CONNECTOR

BNC TERMINAL 93 OHM ARCHET



P10528 — 1-9 $3.50 — 10+ $2.50

BNC RIGHT ANGLE PCB MOUNTING

P10545 — 1-9 $4.95 — 10+ $3.95

BNC PLUG TO UHF PLUG

P10529 — 1-9 $6.95 — 10+ $4.95

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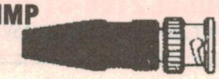

P10530 — 1-9 $3.25 — 10+ $2.95

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P10531 — 1-9 $3.95 — 10+ $3.75

BNC FEMALE LINE JACK SUIT RG59

P10535 — 1-9 $2.95 — 10+ $2.50

BNC PCB MOUNTING

P10544 — 1-9 $4.95 — 10+ $3.95

BNC SOCKETS

"F" SHAPE ADAPTOR PLUG TO TWO SOCKETS

P10604 — 1-9 $9.95 — 10+ $8.95

"Y" SHAPE ADAPTOR PLUG TO TWO SOCKETS

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Solve your networking problems with our varied length ethernet cables. Save heaps!

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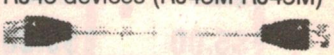
- **BNC 50 OHM 30M NETWORKING CABLE M-M** P37730 ..... **$39.95**
- **BNC 50 OHM 40M NETWORKING CABLE M-M** P37740 ..... **$49.95**

UTP (LEVEL 5) PATCH CABLE

Connecting to 10 BASE "T" and RJ45 devices (RJ45M-RJ45M)



- **RJ45M - RJ45M 0.5M Patch Cable** P37760 ..... **$8.95**
- **RJ45M - RJ45M 1M Patch Cable** P37762 ..... **$9.95**
- **RJ45M - RJ45M 2M Patch Cable** P37764 ..... **$10.95**
- **RJ45M - RJ45M 3M Patch Cable** P37766 ..... **$11.95**
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1MB DRAM FITTED

An all new PCI VGA card based on the Cirrus Logic 5430, that is specficially designed for the Pentium 75MHz and above family of CPUs. Upgrade to higher video display performance with the drivers support and utilities.

Features

- Fully IBM VGA compatible
- Support VESA standard software by BIOS built-in functions
- Support PCI-33MHz (2.0) system with Burst mode
- 64-bit GUI acceleration (32-bit for 5430)
- 64 x 64 hardware cursor
- Support 72Hz vertical scan refresh rate
- VESA standard feature connector
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Construction project:

NEW, IMPROVED FLEXITIMER MK2 — 2

Here's the second of two articles describing our new and enhanced Flexitimer Mk2 — a simple but extremely flexible circuit that can be used for just about any semi-fixed timing application. The author continues by describing the construction of the timer module (after working out the configuration you want), and then discusses ways to extend its capabilities even further...

by ROB EVANS

The first step in building up the new Flexitimer is deciding how the unit will ultimately be used. Then, from that information, you can determine which components will need to be installed in the circuit board. As you can see from the shots of the prototype unit, our timer has all of the DIP switches and a relay installed, and is configured for an AC power source. Since most semi-permanent applications won't need the full complement of DIP switches (or their matching diodes) for the delay time adjustments, there should be less parts to fit into your PCB.

And by the way, we don't recommend using the relay contacts for switching the AC mains to some peripheral device, as this would mean that 240V AC supply is connected directly to the Flexitimer's PCB. As convenient as this may be, there is just too much danger of coming into accidental contact with lethal voltage levels...

If you are using the 50Hz synchronised system however, we would recommend that IC1 produces a clock period that's in round figures — say one second, 10 seconds, one minute or five minutes, as this makes 'programming' the timer much easier. You therefore need to calculate which diodes should be included in IC1's reset AND gate, such as those shown in Fig.2 last month to produce a one minute clock period — see the 'division' figures alongside each decoding diode, on the component overlay.

Other than that, we'd suggest that you include all of the output transistor switching circuits, as these are low-cost parts and the unused ones may come in handy. Once all of the relevant decisions have been made, you can then push on with the quite simple task of putting the timer together.

All of the Flexitimer's components are mounted on one small PCB, which is coded 95tm9 and measures 127 x 55mm. If you've decided not to fit both the relay and AC power supply components, the end of the board can be trimmed off at the point indicated on the component overlay diagram — this trim point is also shown on the copper side of the board, as you would expect. With its length reduced to 108mm the board will then comfortably fit into a standard 41 x 68 x 130mm (UB3) plastic case.

If you have elected to not fit the DIP switches, the various AND gate diodes need to installed in a horizontal, rather than vertical position, so as to bridge the DIP switch connections. The alternative connection points for the diodes are shown in Fig.3, which by way of example shows just the eight-way sections of the EVENT 1 and EVENT 2 gates. Note that the link and two diodes shown actually correspond to the decoding arrangement for the circuit in Fig.1 (last month), which as you can see, uses D32, D35 and a direct link from Q6 to T1 in place of D9.

Complete the circuit board in the

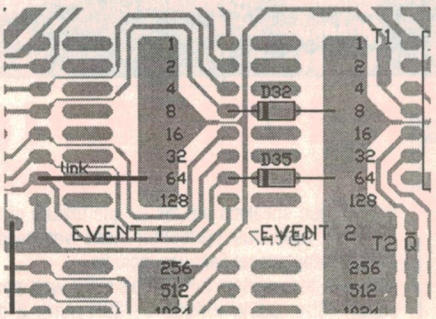


Fig.3: If the delay adjustment DIP switches are not required, the AND gate diodes (or a direct wire link) are installed in a horizontal position as shown. This particular arrangement corresponds to the circuit shown in last month's Fig.1.

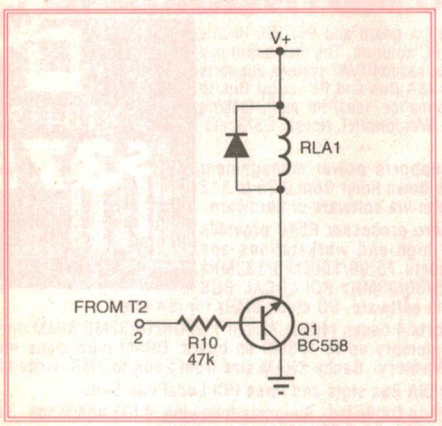


Fig.4: To make the relay normally engaged Q1 can be changed from an NPN to a PNP transistor.

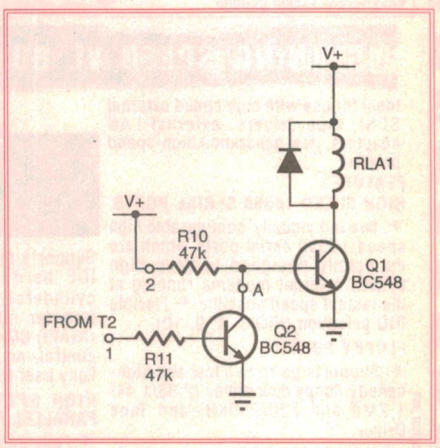
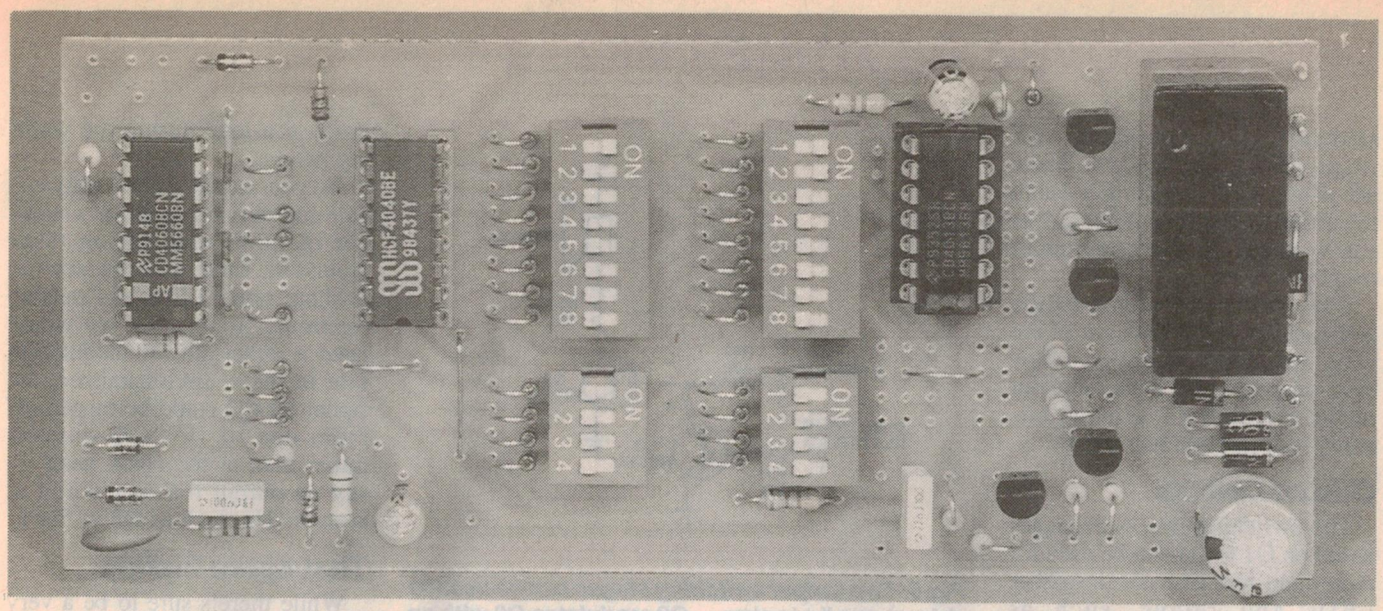


Fig.5: Another way of making the relay normally energised. Here, a spare NPN switching stage (Q2) is used to invert the control level from T2.



The Flexitimer configured as a continuous long term timer with a relay output and DIP switches for the event programming.

usual way, working your way from the low profile components through to the larger parts, while paying careful attention to the orientation of the semiconductors and electrolytic capacitors as shown in the overlay diagram. Note that the IC's all face in the same direction (with pin one facing down) and all of the vertically mounted diodes have their cathode (negative) leg exposed — that is, the lead that must be bent into shape.

Finally, here is a summary of which parts need to be installed for the Flexitimer's different configurations:

- 50Hz mains sync clock: R1, C1, D1, D2 (note link on PCB)
- RC oscillator clock: C2, R2 (or suitable trimpot), R1.
- Clock decoding from IC1: D4 to D13 (as required), R3, R4, D13.
- Cyclic timing mode: R8, D46, R9, C4, D16.
- Single-shot timing mode: D3 (D16 replaced with a link)
- AC power source: D42 to D45, C5, R16.

By using the above guide while referring to our two example circuits (Figs.1 and 2), you should be able to easily determine what parts are needed for your application. Note that when D14 is not required (no output clock decoding at IC1) it should be replaced by a link, as is the case when we don't need D16 (single-shot mode).

Also note that there are two essential links on the board (just below IC2), *plus* the links you need to include for the output options. That is, to connect the output switching as shown in Fig.2, a link is wired between the 'Q-bar' and '2' pads on the pad matrix located below IC3. You could also concurrently link pads 'T2' and '4' to implement the LED2 option shown in Fig.1, since the matrix allows for up to four independent output links.

And as a final point, note that if you elect not to use the clock decoding AND gate at IC1 and make a direct connection to IC2 as shown in Fig.1, then the decoding number labels near D4 to D13 (64, 128, etc) on the overlay diagram are out by a factor of two. This is because the AND gate normally determines IC2's clock period by applying a reset pulse to IC1, and this occurs when IC1's Q outputs go high — at half of their full cycle.

With a *direct* connection from a Q output to IC2's clock input however, the clock period is set by the full cycle of that Q output. Keep in mind that IC2 advances its count on the falling edge of the clock signal at pin 10.

Once the Flexitimer's board is fully assembled, you then need to consider how it will be physically mounted for the job you have in mind. With simple battery-powered timers the assembly can be installed in a standard plastic case as mentioned above, while for mains-synchronised long term applications chances are that the timer will need to go into a larger box, or even inside an existing piece of equipment. In

PARTS LIST

Basic DC-powered version:

Resistors
All 1/4W 5%:

R1	1M
R2	180k (see text)
R5	220k
R6,7	4.7k
R10-13	47k
R14,15	1.2k

Capacitors

C2	3.9nF MKT (see text)
C3	1uF 16VW RB electro
C6	47uF 16VW RB electro
C7	0.1uF MKT

Semiconductors

IC1	4060 14-stage counter w/oscillator
IC2	4040 14-stage counter
IC3	4013 dual D-type flipflop
Q1,4	BC548 NPN transistor

12 x 1N914 signal diodes (D3,15,32,35,etc). Number required depends on 'event' decoding.
2 x LEDs

Miscellaneous

PCB coded 95tm7, 55mm x 125mm (can be trimmed to 108mm); PCB pins; tinned copper wire

Options:

Clock decoder at IC1

R3	4.7k
R4	100k
D4-14	1N914

50Hz master clock
(omit C2, R2)

R1	120k
C1	10nF
D1,2	1N914

Cyclic mode
(omit D3)

R8	100k
R9	4.7k
C4	10nF
D16,46	1N914

AC power supply

R16	100 ohms
C5	470uF 16VW RB electro
D42-45	1N4002

RLA1, D41 if required

DIP switch programming

D17-40 1N914
2 x 4-way DIP switches
2 x 8-way DIP switches

any case (pun intended!), we would recommend that you make use of the three mounting holes in the PCB, which are depicted as screw heads on the component overlay diagram.

With the timer's configuration and construction details out of the way, we can now cover a few hints on how to get even more out of the Flexitimer's existing circuitry, as promised last month.

Output circuits

The switching transistor stages based on Q1 to Q4 can be used for more than just *directly* energising LEDs and relays, such as described in our last instalment. A few examples of this are shown in Figs.4 to 6.

The simple circuit in Fig.4 demonstrates how a PNP rather than NPN transistor can be used to drive the output relay, so that when the controlling signal is at a low level the relay is energised. This is particularly handy when the timer is configured in a single-shot mode where the load is disconnected after a predetermined time delay, and in the interests of current consumption the relay must be de-energised at the end of this period — in much the same way as an 'appliance timeout' unit would operate.

To make the Flexitimer's PCB layout compatible with PNP transistors we've included an extra solder pad on the pin layout for Q2, Q3 and Q4, as this makes it possible to reverse their physical orientation. In this alternative position, the transistors will be connected as shown in Fig.4 (collector to ground), thereby allowing a PNP device to operate as an emitter follower. As you would expect, the relay will then be de-energised as T2 goes to a high level at the EVENT 2 time setting.

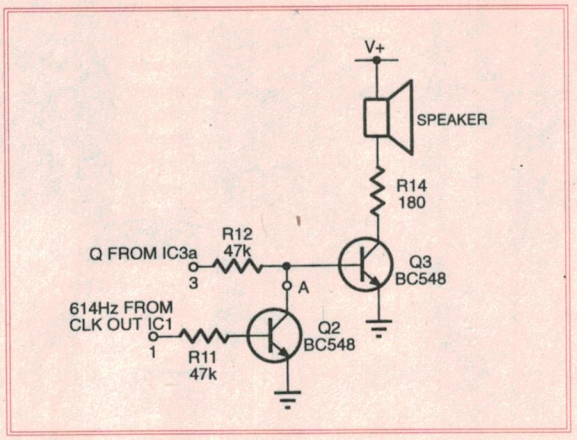


Fig.6: Two output switching stages can be used to drive a small speaker — Q2 modulates Q3 with an audio tone.

The arrangement shown in Fig.5 achieves the same result as that in Fig.4, but in this case two of the standard NPN transistors are used which avoids the need to change component types. Here, the current through R10 from V+ will bias Q1 hard until its base- emitter junction is bypassed by Q2, in response to a high level at T2. So again, when the timer's full period has elapsed (as set by EVENT 2), the relay will be de-energised as Q1 turns off.

The circuit in Fig.6 uses a similar configuration to create an audible indicator circuit based on a small loudspeaker. When used with the last month's games timer (Fig.1) for example, the 'warning' period from IC3a is used to bias Q3 on via R12, while a 614Hz signal from IC1's master clock circuit controls the action of Q2 via R11. Since Q2 is turning on and off at an audio frequency and the current through Q3 will be modulated at that rate, the speaker will produce a tone during the warning period.

As you would expect, this circuit can also be used for a number of other modulation tasks around the timer's circuit, such as flashing status LEDs and pulsing electronic buzzers. As you would need a rather slower modulation rate in these circumstances, the signal for Q2 could be tapped off from one of IC1's Q outputs rather than at the clock itself — say an output that is cycling at around 1Hz, such as Q8 in Fig.1.

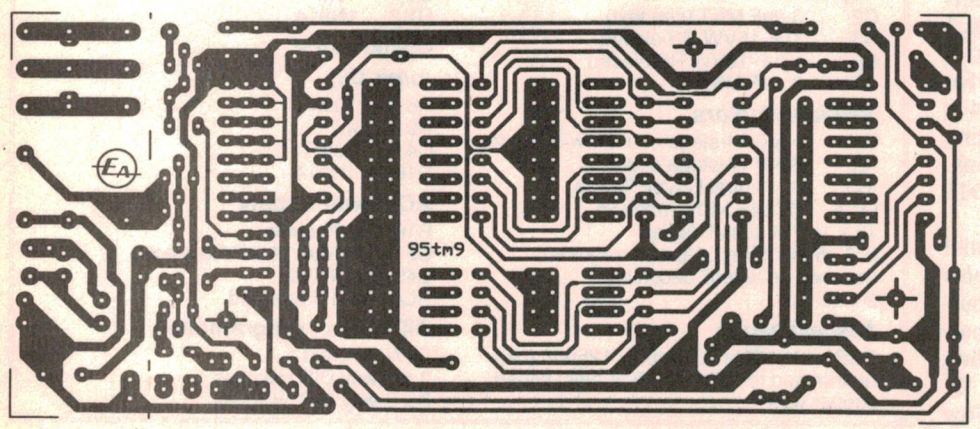
That spare flipflop...

While there's sure to be a very wide range of uses for the 'free' half of the dual D-type flipflop IC3, we've included just a couple of simple configurations that we feel may be of value in the Flexitimer circuit — these are shown in Figs.7 and 8.

Fig.7 shows IC3b connected in a standard divide-by-two, or toggling configuration, where the Q-bar output is tied to the D input. Here, when a rising edge occurs at the CLK input (pin 3) the level at Q-bar will be clocked through to the Q output, so the flipflop will change output states on each successive clock pulse.

If this arrangement is connected at IC2's clock input as shown, the timer's overall delay periods will *double* due to the halved clock rate. So for example the seven-day, 50Hz synchronised timer mentioned last month would then have a 10 (rather than five) minute clock period at IC2, resulting in a delay time of *two* weeks.

With a 50Hz master clock the maximum clock period that can be extracted from IC1 is 5.45 minutes (0.02 seconds times 16,384), so the flipflop provides a



An actual size copy of the timer's PCB artwork, which can be used to etch your own board.

useful extension to the timer's delay periods.

And by the way, in the last installment we neglected to mention that if *all* of IC2's Q outputs are decoded (or all DIP switches selected), a count of 4095 applies. This in turn means that our nominal seven-day timer (five minutes by 2048 counts) can be pushed to 14 days (five minutes by 4095 counts) by using all of IC2's Q outputs. If we then use the clock-dividing flipflop mentioned above, the maximum delay time for a 50Hz synchronised system increases to 28 days.

The configuration shown in Fig.8 has the same toggling flipflop circuit as shown in Fig.7, but in this case IC3b's clock input (pin 3) is driven from a simple inverter stage based on Q3. The flipflop's Q output will therefore toggle on the *falling* edge of the waveform at R12 (input 3).

Since the 4060 counter/oscillator chip does not have a Q10 output, this circuit can be used to synthesize that division by effectively halving the rate at Q9 — note that the counter also advances on the clock's falling edge. By including a diode at the flipflop's Q output as shown, this output can then be used at IC1's clock decoding AND gate in the usual way, making a 1024 count possible. Also note that this circuit could be used on IC1's CLK OUT line to create a Q0 or divide-by-two output.

Other than that, IC3b could be used for a host of latching, (rather than toggling) functions where appropriate events or clock edges are picked off and used to both set and reset the flipflop. In a single-shot timer for example, where the output of the existing flipflop (IC3a) is used to drive a warning indicator and (say) a relay is energised at T2, the spare latch (IC3b) could be used to energise an additional relay at time T1 (the first event). You would therefore have *two* independent relay outputs with one energised at T1 and the other at T2, plus a warning period that occurs between these events.

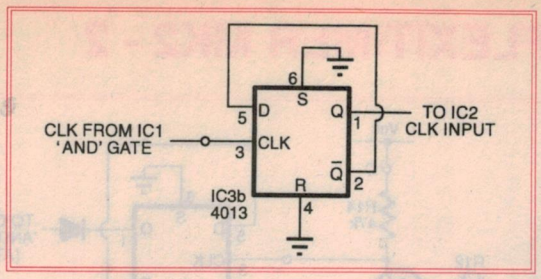


Fig.7: The spare flipflop (IC3b) can be used to halve the timer's clock frequency, and therefore double its overall delay periods.

However you might decide to use IC3b though, there will be a little PCB surgery involved since we've tied all of the unused inputs to ground via thin PCB tracks. Once the inputs that you need have been isolated from ground using an art knife or small sharp screwdriver, you can then include wire links between the spare pads at IC3 where required (say, pin 5 to pin 2), then use insulated hookup wire to connect IC3b to other parts of the circuit.

So that's about it for our general suggestions on how the 'uncommitted' parts of the Flexitimer's circuit can be used — beyond that, the configurations are only really limited by your imagination.

As a last example of how these (plus a few more) tricks can be put into practice, we've included the schematic shown in Fig.9, which depicts a simple but useful version of the Flexitimer that can be built up with just a couple of additional parts.

Alarm, alarm!

As you've probably gathered from the schematic in Fig.9, this circuit is configured as a simple house alarm system which uses standard normally-closed switch contacts, offers a relay output for driving a siren or some other suitable warning device, and can be powered from a DC source or backup battery.

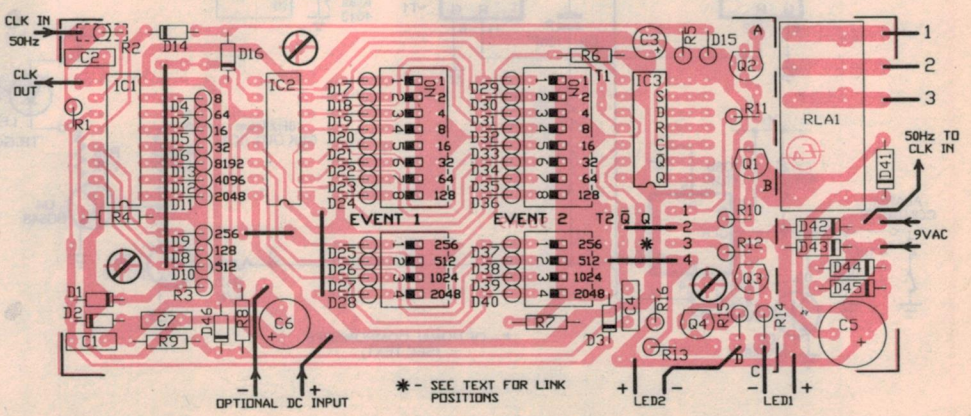
Under static or 'un-triggered' conditions, the sensing contacts hold the clock input of IC3b at a low level, and assuming the flipflop is in a reset state, the high level at its Q-bar output then holds both counters (IC1 and IC2) in a reset condition via R5.

When one of the sensor contacts opens, however, due an alarm condition, the 47k resistor at pin 3 of IC3b pulls the clock input high and causes the flipflop to set — ignore Q2 for the moment. This in turn forces the Q-bar output to a low level, which enables the counters via R5 — also ignore the effect of C3 for the moment.

IC1 then begins counting with a clock rate of 8Hz, as set by components C2, R2 and R1, and produces a 0.5Hz output at Q3 to clock IC2 via the 100k resistor. As IC2's clock (at pin 10) has a period of two seconds, its Q4 output will go to a high level after a delay of 32 seconds, where flipflop IC3a will be set in the usual way. The flipflop's Q output will therefore energise the alarm output relay via R10 and Q1, after an 'entry delay' of 32 seconds.

The alarm relay then remains activated for a further 96 seconds until the flipflop is reset by IC2's Q6 output, which goes to high level after an overall delay of 128 seconds. The high at Q6 is also passed to IC2's clock input (pin 10) via the 1N914 diode, which effectively disables any further counting. The alarm will therefore 'sound' for 96 seconds, after a 32 second entry delay.

The circuit then remains in this state until a period of around eight minutes has elapsed, where Q12 of IC1 rises to a high level and resets IC3b at pin 4. With the flipflop returned to its reset state, the



This overlay diagram shows the Flexitimer board with virtually all options installed. Refer to the text to determine which parts are needed for your application.

now high level at its Q-bar output (pin 2) immediately resets both counters via R5. The circuit is now back to its static state, and providing the alarm condition has been cleared — the contacts have closed again — it's effectively 're-armed' and ready for the next incident.

Note that IC3b's Q-bar output also drives a LED modulation circuit based on Q3 and Q4, so that a 'triggered' warning indicator (LED2) will flash at a fast rate (8Hz) when an alarm event has occurred. This is helpful when testing the alarm, and during the delayed-entry period.

The circuit also offers a fairly crude, but nonetheless effective, safe exit function as well. If the unit is powered-up with one of the alarm contacts open — say, the front door sensor — the alarm latch (IC3b) will not set, since a *rising edge* is needed at the clock input for this to occur. Then as you leave through the front door the contacts close pulling pin 3 to a low level, and the alarm latch is ready to detect the rising edge generated by a valid alarm condition.

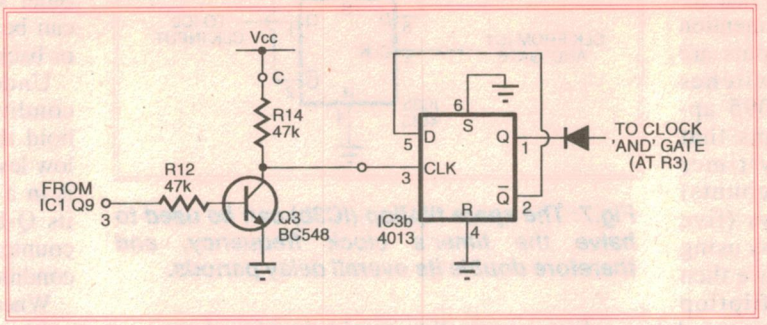


Fig.8: The combination of IC3b and a spare switching stage can be used to create a Q10 or Q2 output from IC1, which can then be applied to the clock AND gate for decoding.

With the circuit as described thus far, a continuous alarm trigger — where one or more of the contacts *stay* open — will only cause the unit to go through one alarm cycle, with the siren sounding for a single 96-second period and no further action taken. Again, this is because the alarm latch (IC3b) is an *edge-triggered* device at the clock input. The continuously open contacts allow pin 3 to stay high and the flipflop will not re-trigger, despite the fact that it has been reset by Q12 of IC1 at the end of the alarm cycle.

However, this is probably quite a responsible arrangement, as it prevents the unit from repeatedly sounding the alarm siren in the event of a false *or* genuine continuous trigger. There's nothing more annoying, or arguably ineffective, than an alarm system that sounds repeatedly for several hours, and appears to be 'crying wolf'...

If on the other hand you really *do* need a system that will cycle continuously until the alarm condition in cleared, you can include the components Q2, R11, C3 and R5 as shown. These parts are used to force the circuit to effectively re-check the state of the alarm contacts at the end of each eight minute cycle, so that the circuit re-triggers if the contacts are still open.

The idea here is that at the end of the eight minute timing cycle the high-level pulse applied to IC3b's reset line also activates Q2 via R11. If the alarm contacts are open, the transistor quickly discharges the 0.1uF capacitor, pulling the flipflop's clock input to a low level and effectively shorting out the alarm contacts.

Continued on page 77

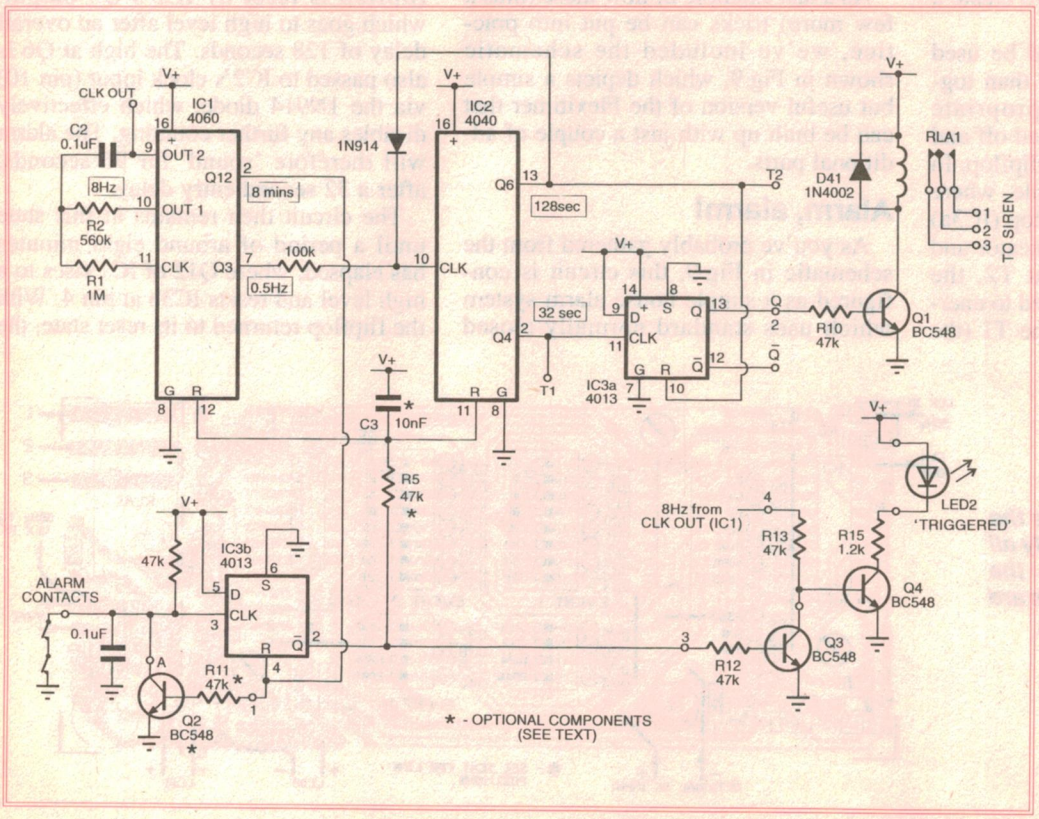


Fig.9: This circuit for a home burglar alarm shows how the Flexitimer's versatility can be put to good use. The alarm has a safe exit function, an adjustable delayed entry period, a 'triggered' warning LED, programmable siren sounding and cycle periods, and can be battery powered.

READER INFO NO. 16

Mini construction project:

LED BATTERY VOLTAGE INDICATOR

Here's a flexible circuit that can be used in just about any piece of battery operated equipment, to combine the functions of a power-on LED and battery voltage indicator. Measuring only 25mm square, the circuit can be easily mounted in the smallest of spaces, to give you warning of impending battery failure.

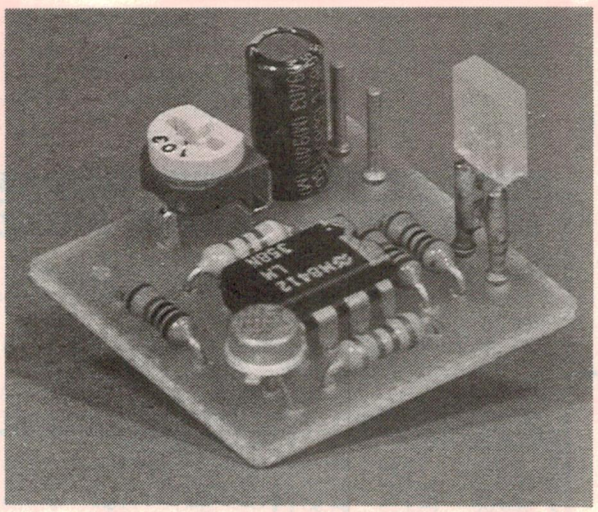
by BOB PARKER

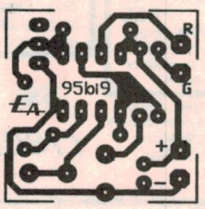
I came up with this little circuit to answer my need for a combination power-on LED and battery voltage indicator, in a compact piece of equipment that I was developing.

Its two-pin red/green LED glows green as long as the battery voltage is adequate, but changes to red when it drops below an adjustable threshold, giving a clear indication of when the battery needs changing. Current consumption is only 3mA at 6V and 8mA at 10V, which is only a few milliamps more than that of a LED on its own.

The circuit is quite flexible, being usable over a voltage range of about six to 30V, and could have other uses.

For example, by simply reversing the LED's connections, it would produce a red glow to indicate that the voltage has *exceeded* a preset value.





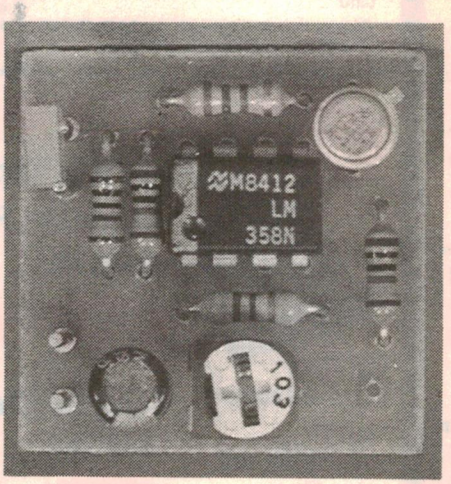
Here is the actual size PCB, reproduced for those who wish to etch their own board.

Building it

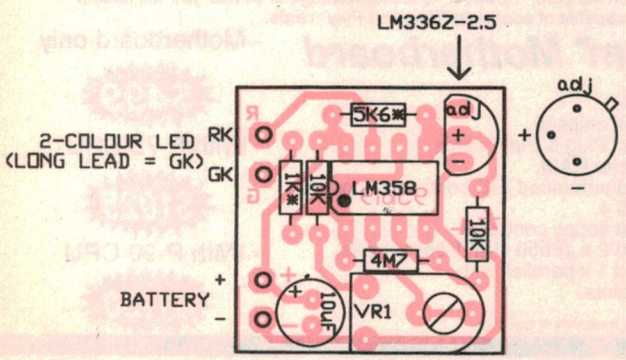
All components except the LED are mounted on a 25mm (1") square PCB coded 95bi9, which doesn't have any mounting holes because it can easily be held in place with a small piece of double-sided foam adhesive tape.

With only nine components on the board, construction is very straightforward. IC1 is available in both the usual TO-92 package and a TO-46 metal can; the pinouts for both packages is shown on the overlay diagram. You can use either a horizontal or vertical mount trimpot for VR1, as the board has been designed to accommodate both styles.

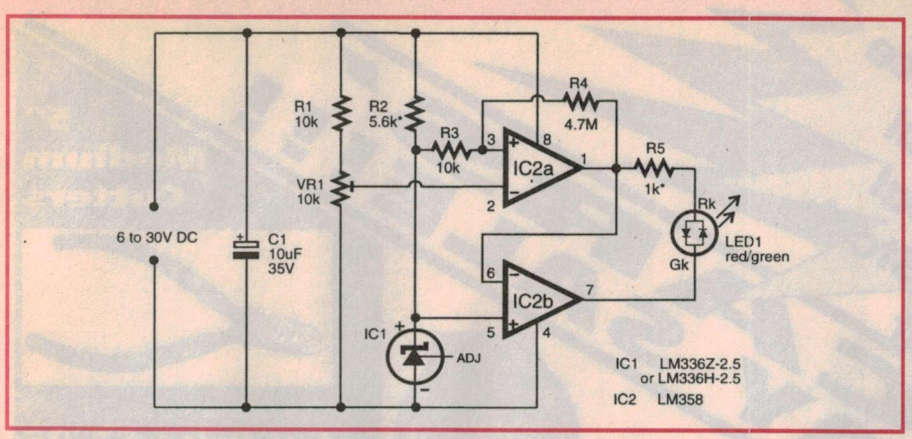
Operation isn't terribly complicated. IC1 is a precision 2.5V voltage reference device, and IC2a compares its voltage with a proportion of the incoming supply voltage, adjusted by VR1. As long as VR1's wiper voltage exceeds 2.5V, IC2a's output stays at almost the negative rail voltage.



This enlarged view of the board (actual size 25mm x 25mm) shows how the components are mounted.



Use this overlay diagram as a guide when fitting the various components to the voltage indicator's PC board. Note that the value of the 5.6k and 1k resistors need to be changed to suit the battery voltage being monitored.



As you can see, the voltage monitor uses a dual op-amp, a voltage reference chip and a dual polarity two-colour LED, with a handful of passive components. Preset pot VR1 is used to adjust the circuit's threshold.

PARTS LIST

R1,3	10k
R2	5.6k (see text)
R4	4.7M
R5	1k (see text)
VR1	10k horiz. or vert. trimpot
C1	10uF 35VW RB electrolytic
LED1	Red/green bipolar LED
IC1	LM 336Z-2.5 (or LM 336H-2.5) 2.5V voltage reference
IC2	LM 358 dual low power op-amp

PCB coded 95bi9 25mm x 25mm; 4 x PC pins; hook-up wire, etc.

IC2b functions as a simple 'inverter'; when IC2a's output is below 2.5V, IC2b's output (pin 7) rises to almost the full supply voltage. The voltage difference between the two outputs causes current to flow through the green half of the LED, turning it on.

If VR1's wiper voltage drops below 2.5V (due to the supply voltage falling), pin 1 of IC2 rises to nearly the supply voltage, while the output of IC2b drops to a very low voltage — reversing the current through LED1, which changes colour to red.

R3 and R4 provide a small amount of 'hysteresis' to IC1a, to ensure a sharp transition between the two states.

The component values on the circuit are suitable for supply voltages of about 9 to 12V, but if you want to use it with voltages outside this range, it may be necessary to vary the value of R5 to keep the LED current in the area of 5mA to 15mA. IC1 only needs about 0.5mA minimum to function correctly, so at higher supply voltages, R2's value could be increased to minimise supply current.

Suitable LEDs for this circuit are Dick Smith catalog number Z-4099 (2 x 5mm rectangular), and Rockby Electronics D1170 or orange/green D1180, which are both 5mm round types.

To set the circuit up, connect it to a variable DC power supply and adjust VR1 until the LED changes colour at the desired voltage. You can now install it in your latest piece of equipment, and never be caught out with a flat battery again. ❖

FLEXITIMER

Continued from page 74

Now, while the flipflop's reset pulse is quite short and it's almost immediately enabled, the clock input will rise relatively slowly as the 0.1uF capacitor charges towards V+ via the 47k pullup resistor. So if the alarm contacts are open, the flipflop will be set when the voltage across the capacitor has risen to the trigger threshold of the clock input.

In effect then, the action of Q2 creates a rising edge at IC3b's clock input if the alarm contacts are still open, thereby re-triggering the alarm cycle. Note that the combination of C3 and R5 slightly delays the reset action of the counters so that the 'eight minute' output (Q12) at IC1 will not immediately fall, therefor allowing sufficient time for Q2 to discharge the 0.1uF capacitor.

By the way, when the circuit is in its normal state and waiting for an alarm trigger, the 0.1uF capacitor will also provide a useful filtering effect at the alarm contacts. In practice, this means that rapid or intermittent fluctuations in the continuity of the contacts will be ignored, thereby reducing the chances of false alarm triggers.

If you would like to try out this circuit, note that you will need to cut a number of small tracks and add several wire links around the Flexitimer's PCB. The additional components can be installed on the board itself, with perhaps the exception of the 0.1uF contact filtering capacitor which could be wired across the connections for alarm contacts. Note that C3 and R5 can be installed in place of the normal power-on reset components, with one end of R5 bridged across to pin 2 of IC3b, as shown in the schematic.

Also note that the extra 100k resistor can be installed in a upright position just above IC1's AND gate diodes, where a couple of spare pads are separated by a thin track which will need to be cut. The entry time (32 seconds), siren sounding period (128 minus 32, or 96 seconds) and cycle time (8.5 minutes) may be changed by factors of two by simply selecting other Q outputs from IC1 and IC2. For example, use Q3 of IC2 for a 16-second entry time, then say Q7 of IC2 for a 240-second sounding period (256 minus 16), and Q13 of IC1 for a 17-minute cycle time.

So there we have a fairly unusual application for the Flexitimer, which should hopefully show just what can be done with this very versatile circuit. And while we're sure that there are a host of other novel and practical ways to use the Flexitimer's circuit, we'll leave them to your imagination... ❖

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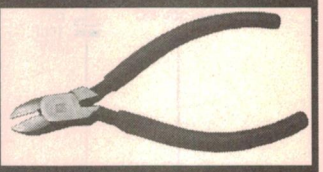

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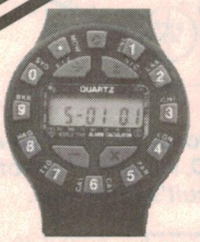

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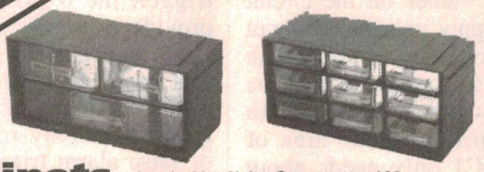

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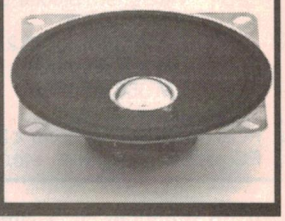

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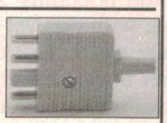

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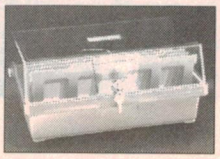

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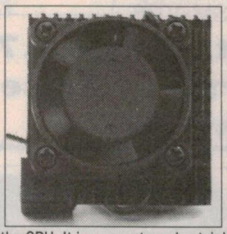

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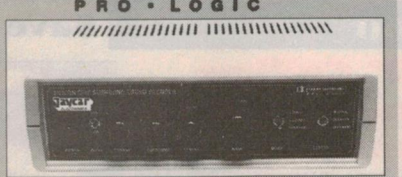

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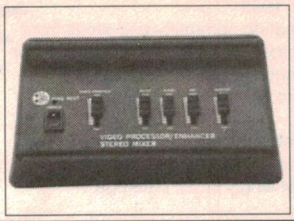

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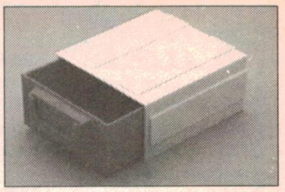

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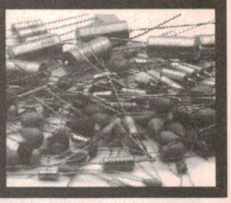

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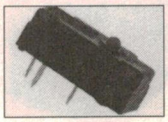

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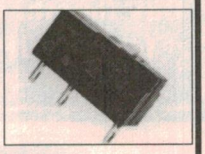

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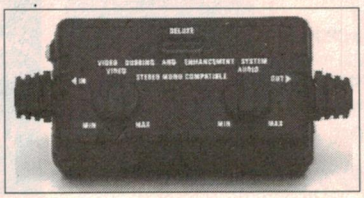

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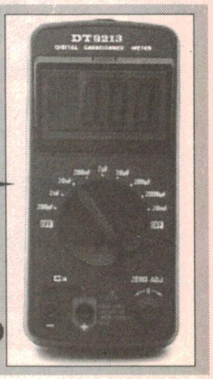

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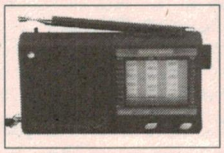

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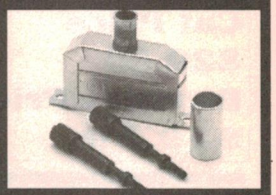

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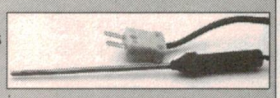

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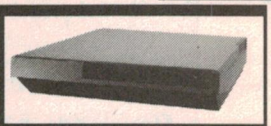

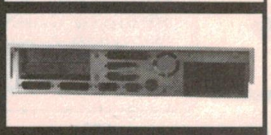

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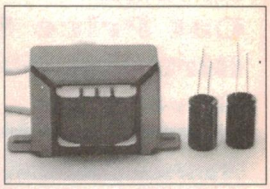

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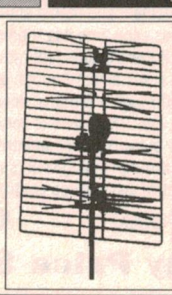

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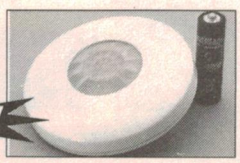

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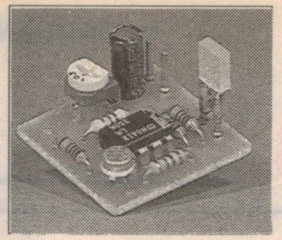

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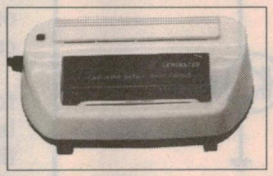

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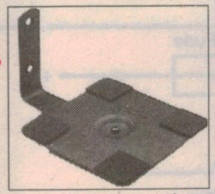

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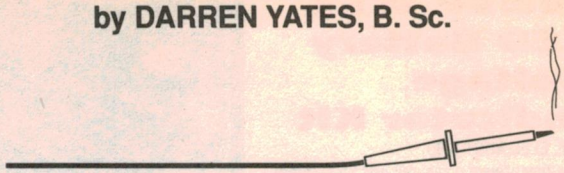
Experimenting with Electronics

by DARREN YATES, B. Sc.



Simple circuits are often the best

This month's column is a licorice-allsorts collection of simple, classic transistor circuits that can either be fitted into many existing projects or be used to form the basis of your own designs.

One of the continuing trends in technology is the drive to make everything as simple as possible. But in order to achieve this utopian state, technology is becoming more and more complicated. One might ask the question just who it is, that things are getting simpler for?

I for one don't mind hurling a stick through the spoke of the spinning wheel of technology every now and then — if for no other reason than to ensure that we don't end up base-over-apex in unnecessary complexity. The concept of discovering 'new technology' could often be mistaken for the ability to 'bury the sometimes embarrassingly simple under a load of jargon and acronyms'. I like to see my task as 'digging it back up again'...

So this month, we're looking at some simple but very useful circuits which have found their way into many a circuit or project over the years.

Lamp Flasher

First cab off the rank is the classic Lamp Flasher — a circuit that has been around since the Ark, I grant you, but one which can still teach us a great deal about how transistors can be used in practice.

Looking at the circuit in Fig.1, when power is first applied the 10uF capacitor is discharged and appears as a short circuit. It then begins to charge, via the lamp GL1, the 4.7k and 150k resistors. Initially, the base of transistor Q1 is held high enough to ensure that its turned off, but as the capacitor charges up, the voltage at the base drops.

Once the base voltage drops enough, Q1 turns on — turning on power transistor Q2. This then lights the lamp and pulls the 'high side' of the 4.7k resistor to almost ground. This causes the capacitor to discharge, turning off Q1 and Q2 as well as the lamp. Q1 is turned off by the fact that there is too little base current to provide sufficient collector current to drive the 100-ohm load to the base of Q2.

With the two transistors turned off, the capacitor charges back up again and the process continues on indefinitely. This circuit is a little unusual in the fact that when the lamp is off, the only current flowing is that charging up the capacitor. Transistor Q1 is a BC557 type while the power transistor Q2 could be a BD139. The only thing you'll need to consider is to make sure that the collector current rating of whatever you choose for Q2 exceeds the current rating of the lamp.

This little circuit could be used for anything from an emergency breakdown flasher right down to the crossing lights on a model railway. It's only limited by your imagination.

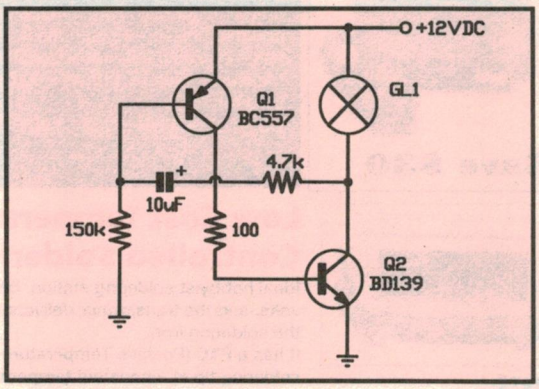


Fig.1: A simple lamp flasher.

Fuse Blown Indicator

One place where a flasher is handy is as a blown fuse indicator. A simple circuit using a LED flasher is shown in Fig.2. The operation of transistors Q2 and Q3 should be quite easy to understand as they operate as the standard astable multivibrator which we've looked at in an earlier episode. However, the operation of Q1 may be a little puzzling to some.

In normal operation, the circuit does absolutely nothing and uses no current either. The fuse is a short-circuit which ties the base and the emitter of Q1 to the same voltage point. This ensures that Q1 is as off as the traditional bucket of prawns in the midday sun. But when the fuse blows, base current flows through the 4.7k resistor to the circuit load, which turns on Q1 — thus providing supply voltage to the LED flasher, which now indicates that something has gone wrong.

The RC components in the flasher section of the circuit are chosen to give a slow and visible flash. This circuit will work well in any DC application where the fuse is in the positive supply side of the load.

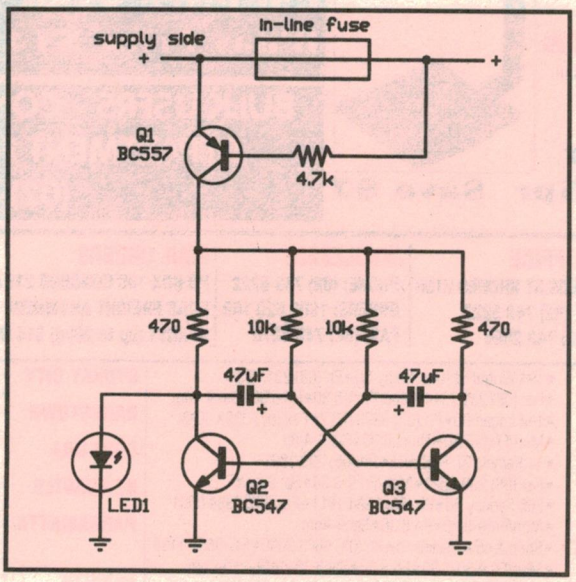


Fig.2: A blown fuse indicator.

To use the circuit in the negative supply load, simply swap all the transistors — PNPs for NPNs, and vica-versa. Also swap the grounds to the positive supply rail and reverse the polarity connections of the capacitors.

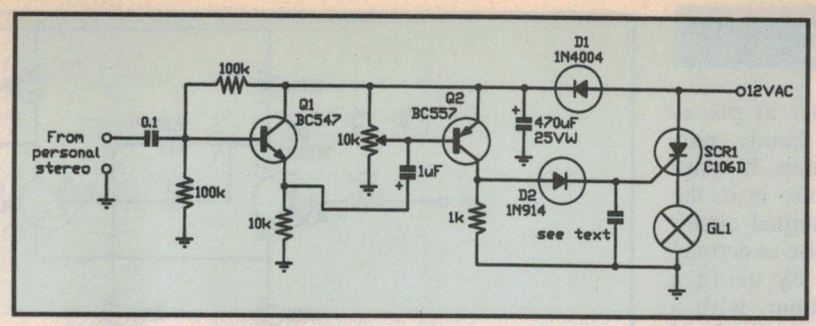


Fig.3: A sound to light modulator.

Light Modulator

Our next simple circuit uses a component we haven't yet discussed, called a 'thyristor' or *silicon-controlled rectifier*. As the later name suggests, it is basically a big controllable diode and is often used in AC mains circuitry.

While that area is potentially too dangerous for us to handle adequately here, SCRs can also be used in low voltage AC applications such as the Sound-to-Light Modulator in Fig.3.

An audio signal is taken from the output of your personal stereo or radio, and fed through a buffer circuit based around transistor Q1. This simply provides some isolation between your personal stereo and the rest of the circuit. The buffered signal is then AC-coupled to transistor Q2. This PNP transistor is connected up as a detector by virtue of the positioning of pot VR1. We'll come back to this in a minute.

Q2 works on the negative half of the incoming sound waveforms. The positive-going halves of the waveforms simply push the transistor further and further off, while the negative halves turn the transistor on, allowing current to flow. A diode at the collector of Q2 siphons the current flow to the gate of the SCR.

Now SCRs work differently to transistors and this needs a little explanation. In this circuit, the SCR is connected directly to an AC supply of 12V. When current is applied to the gate of an SCR, it switches on and stays on whilst the diode is forward biased — even when you remove the gate current. And that's one of the main differences between transistors and SCRs. Because of this characteristic, they were (and still are in some places) used as memory cells.

The only way to turn the SCR off is to either reverse bias it — i.e., make the cathode more positive than the anode — or starve it of current, in which case it just forgets whether it was on or off and decides to stay off instead.

By using an AC supply, the SCR is reversed biased every half cycle, which means that the maximum time the SCR is on for any one period is half a cycle of the 50Hz mains or 10ms.

Only the SCR runs from a straight AC supply. The rest of the circuit is supplied with a rough-and-ready DC via the diode rectifier D1 and the 470uF reservoir capacitor. Capacitor C3 at the gate of the SCR can be added to make the lamp GL1 stay on longer, by acting as a reservoir fed by the current from the detector transistor Q2.

No one can deny that this circuit is as crude as you can get, but it does the job and shows you that you can do quite a lot with just a handful of components. The 12VAC supply can be taken straight from your AC plug pack. Just as a helpful hint, try the circuit without capacitor C3 to see what you get and then start adding it in until you get the desired effect. Start off with 0.1uF and work your way up. Don't forget to fuse the supply as well, just in case something goes wrong.

The lamp should be a 12V type, of up to 5W rating. You could go higher, but this puts more strain on the plug pack. By sticking with lower power lamps, you can run more of them and get some different effects.

What more complicated circuits do is to use the different frequency components of the sound input to drive different lights. This means you could have one for the drum beat, one for a guitar, etc. Looking at Fig.4 briefly, you can see that an SCR can be made up from two transistors back to back — one PNP and one NPN. Once base current is supplied to the NPN, it turns the PNP on, which now takes over supplying current to the NPN and around it goes. The only way to switch it off, as we said earlier is to stop the current flow to the SCR's anode.

Schmitt triggers

Most people know Schmitt triggers as part of a CMOS IC package. These ICs are great, but they're a bit of a pain if you only want one and not six. As it happens you can build your own, using a couple of NPN transistors.

Before we go into the circuitry proper, let's go over briefly the function of a Schmitt trigger. Basically, there are two voltage thresholds, appropriately named the *upper* and *lower* thresholds.

If we think of it in digital logic terms, the output of a Schmitt trigger does not go high until the input voltage has surpassed the upper threshold, and does not go low until the input drops below the lower threshold. The area between the two thresholds is known as the *hysteresis*, and whilst the input voltage remains in this area, no change occurs in the output.

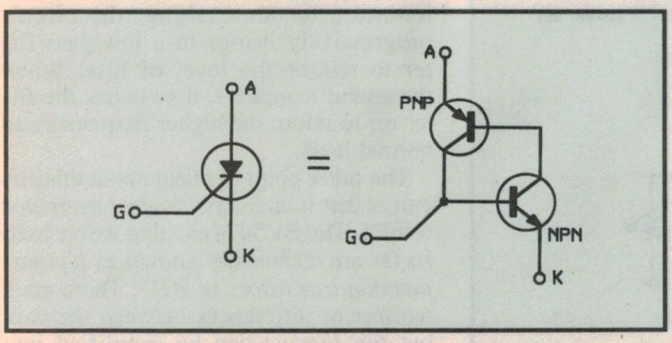


Fig.4 (above): The equivalent circuit of an SCR.

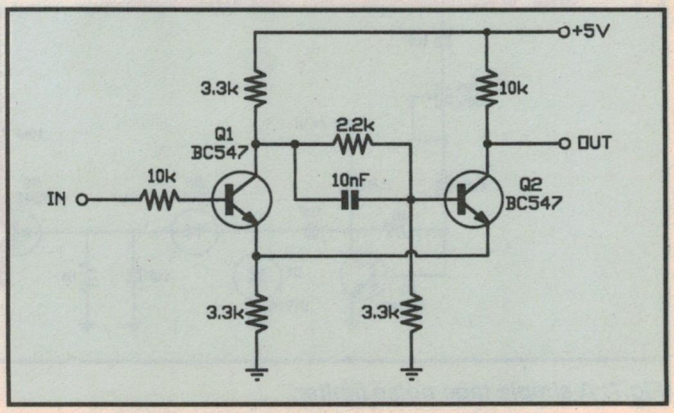


Fig.5 (right): A schmitt trigger using NPN transistors.

Now there are a number of places where this behaviour is handy, particularly in frequency counters. If a signal has a good deal of noise in it, the noise itself can make a normal circuit mis- count by taking the noise as definite changes in signal. But by using a Schmitt trigger at the input, with a hysteresis larger than the amplitude of the noise in the input signal, the noise is effectively removed and the original signal appears 'cleaned up' at the output, ready for counting.

Schmitt triggers are commonly used in digital logic circuits for this reason. Another example is in the 'front end' circuitry of a car tachometer. The signal from the car itself, even when reduced in voltage, will still have a good deal of ringing and unwanted noise. A Schmitt trigger here will clean out the noise and produce a clean pulse at the right frequency.

Looking now at the circuit in Fig.5, assuming the input is low, transistor Q2 is turned on via the base bias from the divider formed from the series connected 3.3k (two) and 2.2k resistors. The voltage at the base of Q2 is around 1.8V, and with the drop of 0.6V across the base-emitter junction, the emitter of Q2 is sitting at about 1.27V.

With the 3.3k emitter resistor, this means that there is about 380uA flowing through the collector. The 10k collector resistor causes the transistor to saturate, and the collector sits at about the emitter voltage — i.e., 1.27V.

When the input voltage is increased, and becomes higher than the emitter voltage, Q1 begins to turn on. This pulls Q2's base voltage lower. The current flow from Q1's emitter is now flowing through the emitter resistor, which causes the voltage at the emitter of Q2 to rise. 'So as Q2's base voltage lowers and its emitter voltage rises, Q2 is forced off in a hurry. The voltage at its collector rises rapidly to the supply rail.

The level of hysteresis is governed by the emitter resistor shared by Q1 and Q2. Increasing the value of this resistor increases the level of hysteresis and vice versa. Try changing this value to see what effects you get. You will also get different effects by changing the supplyvoltage.

The 10nF capacitor is designed to improve the circuit action at high frequencies, but can be removed for low frequency work.

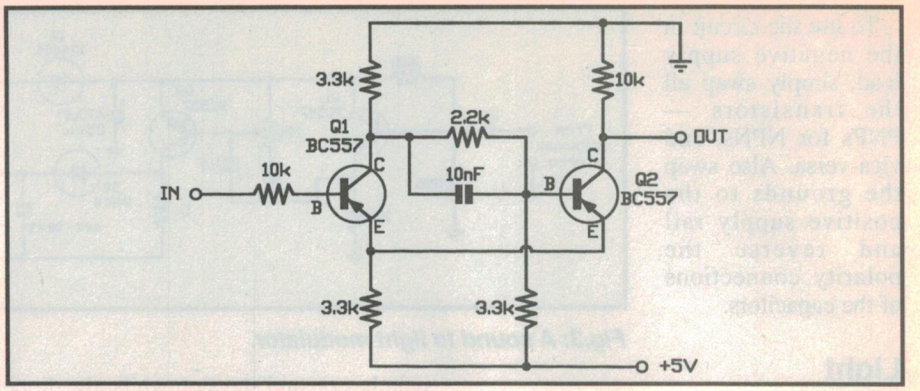


Fig.6: A schmitt trigger using PNP transistors.

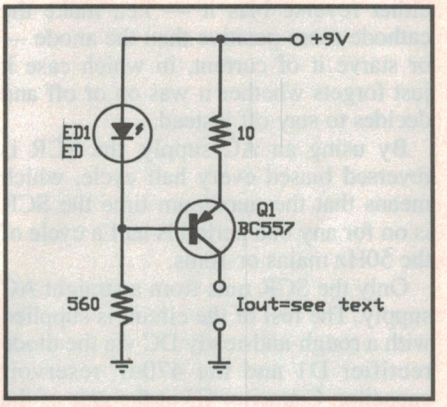


Fig.8: An improved constant current source.

As well as this circuit works, it only has one problem and that is that the output doesn't drop all the way to ground. However, it does rise all the way to the positive supply rail. This suggests that it could be reworked with PNP transistors instead, and that's what we've done in Fig.6.

As you can see, the circuit is basically the same except those components which used to be tied to ground are now connected to the positive supply rail and vice versa. All of the component values are the same in their respective positions. The output for this circuit now swings between 3.8V and ground.

Unfortunately with this circuit, it isn't possible to obtain a rail-to-rail swing. However this PNP version will work well with any CMOS circuitry.

Tape Noise Limiter

Being an audio recording enthusiast, this next circuit caught my eye at a very young age. Again, it's as crude as you can get; but for a simple, low cost circuit it does the job adequately for basic home recording. It's a Tape Noise Limiter, and it also takes us into the world of audio filters, which is taught as part of any undergraduate course.

The basic idea of this circuit is that it fits in between your cassette deck/personal stereo and your amplifier. When the quiet passages of whatever you're listening to come along, the circuit progressively brings in a low-pass filter to reduce the level of hiss. When the sound reappears, it switches the filter off to return the higher frequencies to normal level.

The other point to make about this circuit is that it uses a *field-effect transistor* or FET. The BC547s etc, that we've used so far are technically known as *bipolar-junction transistors* or BJTs. There are a number of differences between the two, but the biggest can be simplified into saying that BJTs are current-controlled while FETs are voltage-controlled.

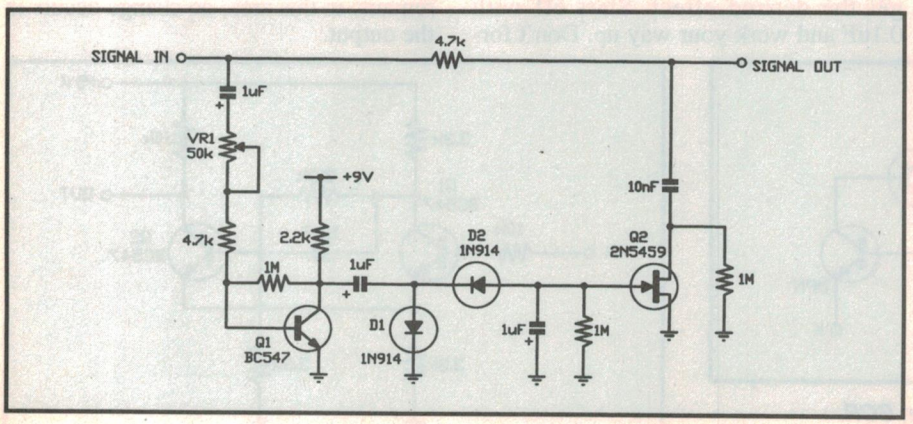


Fig.7: A simple tape noise limiter.

Another difference is that while BJTs have base, collector and emitter connections, FETs have gate, drain and source connections instead.

We've seen already that ordinary bipolar transistors don't have a very high input impedance, and that's OK, because there are times when you don't really want one. However, there are times when you want to amplify a very weak signal that can hardly supply a whiff of current. An example is a radio signal from an aerial in a crystal radio.

FETs generally have a very *high* input impedance, which means that they don't load down the signal you want to amplify. Use a BJT in a crystal set and you'll be lucky to hear anything — use a FET and you'll get a much stronger audio output.

In this circuit, we're using the FET as a voltage-controlled resistor, which simply suggests that as we vary the voltage to its gate, we vary its drain-source resistance. If we apply a negative voltage, that is a voltage below the source in magnitude, the drain-source impedance increases and the FET is pushed further into the 'off' region.

Now I say 'impedance' because we are using the FET as a purely resistive element — there is no DC flowing through the drain or source, by virtue of having a 10nF capacitor in series with the drain.

Looking again at the circuit in Fig.7, the input signal is taken from the cassette deck and divided into two paths — one is the main audio signal path via the 4.7k resistor. The second is a voltage path, which turns the AC signal voltage into a DC voltage.

Following the second path, the signal is AC-coupled via a 1uF capacitor to the base of transistor Q1, via a 50k sensitivity pot and a 4.7k resistor. Q1, a common BC547 NPN type, is connected up as a simple common-emitter amplifier with a gain of about 70. This amplifies the input signal to a point where it appears at the collector of Q1. From here, the two diodes and 1uF capacitor form a negative voltage rectifier, where they turn this amplified AC signal into a DC voltage which is below 0V. This voltage is then fed into the gate of FET Q2, which is a 2N5459.

With no input signal, the FET's gate is basically at 0V thanks to the 1M pull-down resistor. The drain-source path of the FET is now a low impedance, which pulls the low-pass filter formed by the 4.7k resistor and 10nF capacitor into play. But once the input signal arrives, the gate voltage is pulled negative, turning off the FET. This increased the impedance to ground and pulls the filter out of circuit.

The circuit's sensitivity, or the rate of action is controlled by VR1. It may not come close to the latest Dolby S noise reduction system, but for a couple of bucks I don't think it's too bad as a circuit to have lying around. Don't expect hifi quality results with it, though!

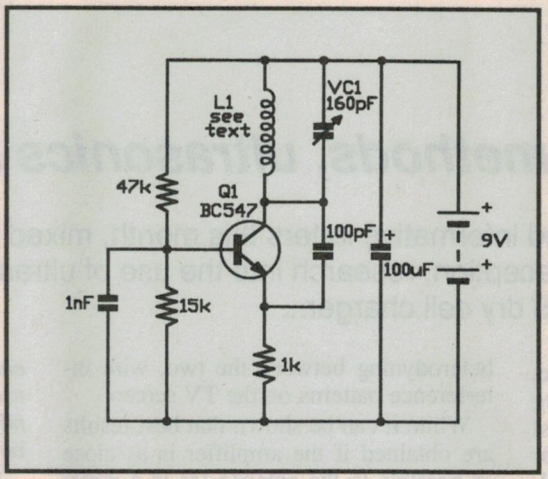


Fig.9: A simple metal detector.

Improved current source

A couple of months ago, we presented a circuit for a current source which used a couple of 1N914 signal diodes as the current control. Since then I've been told of an improvement which replaces the diodes with a red LED or light-emitting diode. The benefit here is that the LED much more closely matches the temperature characteristics of the transistor, and results in a current source which has much better thermal stability. The new circuit can be seen in Fig.8.

The original circuit would vary its output current depending upon the temperature. Thanks to the LED, this circuit counteracts the transistor and balances out the differences for much greater stability. The rule-of-thumb formula now changes to be approximately 1/Rx instead of 0.6/Rx, because of the extra voltage drop from the LED.

An added advantage of this circuit is that the LED provides visual indication that it's operating.

Simple metal detector

There have been some pretty popular transistor circuits created over the years, but you'd be hard pressed to find one more popular than the Simple Metal Detector.

It seems any circuit which can conjure up images of finding sqillions in lost gold will always be a winner...

The simple truth is that you're not likely to find too much in the way of gold using this circuit, unless its about the size of Ayer's Rock — but it does display a curious property. When a piece of ferrous (iron-based) metal is brought near the search coil, it has the effect of changing the coil's inductance. Not by any great amount, but enough to make it easily distinguishable. And it's this basic property that all metal detectors or locators use.

If we take a look at the circuit in Fig.9, you can see that there's very little to it. However, you need to have a portable AM broadcast-band receiver close by. Our metal detector is basically a very weak radio-frequency (RF) transmitter, whose frequency is determined by the tuning capacitor VC1 and the search coil L1.

The 100pF capacitor between the collector and emitter provides positive feedback to ensure that the circuit starts and keeps oscillating. The AM radio is tuned to a weak station, whilst the metal locator is also tuned to the same spot. You'll know when it is, by the presence of a whistle or beat-tone in the speaker. By bringing your hand near and away from the coil, you'll hear the pitch of the tone change from the speaker.

If you have a couple of four-inch nails handy, leave them on the table and pass the search coil overhead. You should hear the tone from the radio drop and then rise again as you pass over. As I mentioned before, the nails change the inductance of the coil, which causes a change in the oscillation frequency. This also changes the beat frequency from the radio as well.

What happens is that the metal locator's RF signal *mixes* or beats with the weak station in the radio receiver, to produce the audible difference between the two. (It also produces the *sum* of the two frequencies, but you won't hear those...)

The transistor can be just about any common NPN device and if you only have a PNP type handy, you can easily follow the swap-rule we've mentioned before and use one of them instead.

Next month, we'll move into the world of operational amplifiers or 'op-amps' — again, looking at some of the common and not-so-common circuits. ❖

(Darren Yates is Chief Engineering Officer with R.A.T. Electronics, of PO Box 641, Penrith NSW 2750.)

INFORMATION CENTRE

by PETER PHILLIPS

Suspect testing methods, ultrasonics and more

We have a mixture of irate and informative letters this month, mixed in with those simply asking a question. Topics include TV reception, research into the use of ultrasonics, varying the speed of a CD player and the January '95 dry cell charger...

A serviceman friend once said to me, when I told him I was considering moving to a new house, "The best views in the world don't make up for lousy TV reception". It's advice I've always remembered, as despite my claim that 'I don't have time to watch TV', it's amazing just how many hours of TV viewing I seem to clock up.

This advice was given to me some 25 years ago, when masthead or distribution amplifiers were unusual additions to a TV antenna installation. Even so, I remember helping my father in the late 1950s install a TV antenna on a property around Oberon, in the NSW Blue Mountains. The antenna was mounted on the top of a hill, some 500 metres from the house.

To compensate for losses in the antenna cable, an all-valve RF amplifier was installed at the base of the antenna mast, which meant running a 240V mains supply for the amplifier. I mention this to point out that TV signal amplifiers of one form or another have been around for many years.

These days, many TV installations include a masthead amplifier or a signal distribution amplifier as a matter of course. While these devices can be effective, and even essential in some cases, they are not a panacea to all reception problems. The main reason is that everything picked up by the antenna is amplified, including ghost and interference signals.

As well, reception is often poor for only one or two TV channels. However unless you use a distribution amp with separately adjusted channel amplifiers, the strong and the weak signals are both amplified equally, giving overload on the strong, possible improvement on the weak signals, and the possibility of heterodyning between the two, with interference patterns on the TV screen.

While it can be shown that best results are obtained if the amplifier is as close as possible to the antenna (as in a masthead amplifier), a suitably designed distribution amplifier is often the only way around the problem of needing amplification of one channel only. I'm saying all this by way of introduction to our first letter, which asks for advice about improving TV reception. I'll continue, but first here's the letter...

TV reception

I currently live in a block of townhouses as an owner/occupier. There are seven units in the block. I am writing to ask you about TV aerial connections in such places, in particular about the use of masthead amplifiers and the availability of 'in-line' amplifiers that can be connected to the aerial line at the wall outlet — if such a device exists. If an in-line amplifier does not exist, what would be involved in designing such a unit as a construction project in a future issue of the magazine?

The background for this letter is my current TV reception. I get close to perfect reception on all channels on the TV set in the bedroom, but I get poor reception of the ABC at an aerial outlet in another room.

What I want is a project for an TV aerial amplifier that can be plugged into the antenna cable from the aerial wall socket to the video/TV, to increase the signal strength to produce a clear sharp picture on the TV. The amplifier might be powered with a low voltage plug pack transformer.

The person who installed my second aerial socket mentioned that for a single dwelling a gain of only 40dB would be enough, but where seven townhouses are using the same aerial, a gain of 100dB might be needed. (Paul Myers, Queanbeyan, NSW.)

Distribution amplifiers (as they are called) are available commercially Paul, although they can be fairly expensive. In principle, these amplifiers are similar to a masthead amplifier, except they usually include a splitter, a power supply, and possibly a gain adjustment. Some even provide separate amplifiers for the various channels, with their own gain adjustments — like the Alcad units currently available from Peter Lacey Services, of 80 Dandenong Road, Frankston 3199; phone (03) 9783 2388, or fax (03) 9783 5767.

We have not presented a distribution amplifier as a project, but an alternative is to use a masthead amplifier, like that presented in *EA* for December 1988 or March 1987. A more modern design is described in the Miracle Antenna project in May 1992.

However, as I've already said, you might find adding such an amplifier causes more problems than it solves. For instance, while weak channels might be improved, strong channels might cause overload. As well, ghosting will be more evident, as will any interference.

For starters, I suggest you look at the projects I've mentioned, and consider building a basic masthead amplifier, but connected at the wall socket instead of at the antenna. If it gives a useful improvement, then perhaps consider a commercial distribution amplifier. If not, you won't have wasted a lot of money.

Readers might have noticed that I have deftly steered away from agreeing with our correspondent about designing a suitable amplifier as a project. While a basic VHF/UHF amplifier project is

relatively easy to produce, it's very difficult to design one that solves all the problems I've mentioned.

Ultrasonics

In July, I discussed the merits or otherwise of ultrasonic devices that claim to repel mosquitoes and other nasties. Here's a letter from a reader who has been involved in this type of thing...

I have just read your interesting article in July EA regarding ultrasonic insect repellers. I too have purchased a number of these devices in an effort to keep mosquitoes away, mostly in the jungles of SE Asia, but I can't say any of them worked 100%.

Of far more use was the ubiquitous mossie coil, or failing that, a burning pat of dried cow dung — although not the nicest smell! I've also heard that dollops of tiger dung sprinkled about will keeps dogs away. Unfortunately it's a bit hard to get, and I made quite a fool of myself in Java trying to buy some tiger dung from a travelling circus. Alas, my lack of language skills and meaningless hand signals convinced the tiger owners I was quite mad. Too much midday sun!

However I believe the ultrasonic principle works, if the unit is designed correctly and with perhaps more power than that possible from a tiny battery. Many years ago I worked in London, at a company called Omega Laboratories. One of our products was a device known as a 'Cat-Amp'. This was in effect a 23kHz oscillator, fed into an 80 watt amplifier feeding an array of piezoelectric tweeters.

These units were used in granaries to chase rats away. They certainly worked, as shown in laboratory tests with a cage full of rats. A frequency of 23kHz would send them into a panic, whereas other frequencies seemed to make them want to eat more, or to mate furiously.

It was common to mount 12 tweeters on a flat board, and at 23kHz the ultrasonic beam was quite sharp, rather like an RF beam antenna, and this of course increased the power gain in the desired direction. While we in the lab could not hear the sound, it was considered risky to stand in front of the system when it was turned on.

In fact, mounting the array outside, we conducted some on/off tests with staff standing several hundred metres away. Most of us could accurately determine when the unit was switched on, although we couldn't hear anything. Somehow, you would 'sense' it.

We also had some other interesting projects in ultrasonics. One was an airport noise monitor for Heathrow airport, where pilots were 'booked' if they exceeded certain recommended noise levels. But from this came the development of a jet engine analyser, in which the noise of the engine was fed into a computerised system and various components of the sound analysed.

These were found to relate to the condition of certain bearing and moving parts, so I gather one could determine, for example, that the third bearing in the fifth widget was about to fly apart if it didn't get some oil. Apparently this technique has since been developed a great deal further.

Another interesting project was a traffic noise monitor. These units were placed around the city in selected noise problem spots, and coupled by modem back to the lab for analysis. At first we were stunned to find the monitors being grossly overloaded, but this was traced to an enormous amount of energy being generated in the ultrasonic region.

Most people have had the experience of a bus or truck pulling up alongside with squeaky brakes, (producing a brain-splitting headache), but there appears to be considerable energy (possibly kilowatts) released at ultrasonic frequencies. Perhaps this is part of the reason for city life being so stressful. (Peter Robinson, Crows Nest NSW.)

Thanks for this interesting insight into the world of ultrasonics, Peter. As I said in July, if ultrasonics is going to do anything useful, it must have an appropriate output power. It's therefore interesting to hear of experiments involving high power ultrasonics, and of the uses of such a technology. I notice too that the frequency is important, not just the fact that it's ultrasonic. Most of the readily available ultrasonic transducers resonate at around 40kHz, which is along way from the 23kHz used to repel rats. So maybe there really is an ultrasonic frequency that mosquitoes absolutely detest. But so far no one seems to have found it.

Returning now to the type of sound we can hear, here's a letter from a reader who is starting out in electronics.

Surround sound

Congratulations on a great magazine! I have read your magazine every month for a year and a half and I always refer to back issues in libraries. Actually, I haven't built any of your projects yet, except for a battery charger. I am nearly 15 and I'm going to put together a Home Cinema, a damn good one too, I hope. I am currently trying to fix an early 80's Colourama Kriesler TV set, which at the moment is a Monorama. It won't be that outdated if I get it going, as all it lacks are features like remote control and so on.

I'm going to build a Pro Series III power amp and some LM3876T-based surround amps, which I will use together with my currently dud TV and other ready-built components. At this stage, I can't decide on the speakers.

NOTES & ERRATA

Water purity tester (Circuit & Design Ideas, July 1995): There are two corrections to the circuit. (1) The voltage at the collector of Q2 should read 7V (not 4.7V) and the asterisk (*) note should read 'choose value to give 7V at the collector of Q2'. (2) R17 should be a 1k resistor, not a 1-ohm resistor as shown.

PC driven electrocardiogram (July 1995): There is an error in the BASIC listing published on page 61 of the July issue, which will prevent the program from displaying a trace on the screen. Line 140 should actually read:

```
140 FOR I=0 TO 640: Y=PEEK (&HFC4F+I)-110: IF Y>8 THEN LINE -(I,Y)
```

Note that the error is only in the printed listing for the simple program, and the full version of the software (PC-ECG) can be downloaded from the EA BBS (353 0627), or ordered through our Reader Services Department.

Note also, that the 100uF electrolytic labelled C14 should be labelled C15 on the circuit diagram Fig.1, and that the real C14 (0.1uF) connects between V+ and V-, not ground as shown. Both the PCB and the parts overlay diagram are correct.

Playmaster 300W Subwoofer Amp (April 1995): The amp module's schematic on page 61 incorrectly shows the lower end of C6 connected to the right hand side of R13 (the main output). It should in fact connect to the left hand end of R13, at the base of Q4.

The PCB artwork and overlay diagrams are correct as published.

Stereo TV Sound Receiver (January/February 1995): To achieve the correct 7kHz high-end rolloff for the rear 'surround' channel, C41 should be increased in value to 33nF.

Economy Surround Sound Decoder (May 1995): To active the correct 7kHz high-end rolloff for the rear 'surround' channel, resistor R10 should be increased in value to 6.8k.

Power Transistor Tester (May 1988): Although the base current adjustment circuit appears to have been calibrated for a collector current of 600mA, with a 12 ohm collector resistor as shown the LEDs will indicate a null at a collector current of 500mA with a 12V supply rail. To improve the accuracy of gain readings, the collector resistor can be reduced in value to 10 ohms — if desired, by shunting the present value by two 120 ohms/1W resistors in parallel.

Anyway, I was wondering if you could design a THX surround sound processor. I have heard that these can (if the speakers are set up well) greatly improve the sound from a Dolby Prologic decoder. Certainly I have been very impressed by a demonstration of this system. THX also seems to be the choice of higher end systems, like the Onkyo TX-SV919THX unit and the Kenwood KC-X1/KM-X1 systems, which you've reviewed at EA. Of course, such systems are a distant dream, budgetwise, because I have to finance myself. I want to have a whole system for much less than $4000, not just a THX processor with power amps! (Paul Kunmiek, Grovedale, NSW.)

It's always good to hear from younger readers, especially one so enthusiastic. Regarding a THX system, the licence cost to use THX decoder circuitry is many thousands of dollars. Even if we did design such a unit, it would cost you a fortune to buy it. As well, a full THX system needs THX certified speakers, including dipolar speakers, a subwoofer and so on. It costs lots!

However, don't write off Dolby Prologic or even basic surround sound. The effects can be quite excellent. For starters you might like to build the simple surround decoder described in the May '95 edition. It won't cost much and it gives quite reasonable results. Incidentally, the rear speakers (or 'effects' speakers as they are called) can be any basic speaker. But make sure you use a reasonable quality centre speaker and good left and right front speakers. Good luck with the Kreisler TV — they were a good set in their day!

Variable speed CD players

This topic has popped up nearly every month, and this month I'm presenting three letters that each contribute differently to the subject.

There are a few CD players available with variable speed, but most of them only give a speed variation of +/-7 to 10%, which seems to be inadequate for ballroom dancing purposes. However, a lot of standard CD players can be converted to +/-20% (more if absolutely necessary) by Bob Yorston, of 29 Trafalgar Ave, Roseville 2069.

As far as I know, he converts all types of CD players (if they can be converted), rather than concentrating on a single brand. In fact it seems to be quite a 'cottage industry', with most of the non-commercial variable speed CD players in Australia, New Zealand, Malaysia and Canada being done by him. (Beverly Lewis, Elanora Heights NSW.)

In July I gave the address of someone in Victoria who also modifies CD players to give variable speed. So thanks for this information Beverly, we now have NSW covered. It seems to be a more popular need than we first thought, and one that is clearly possible. The next letter discusses the issue in more detail:

In February you compared a CD player to a piano roll, and suggested that it should be possible to alter the playback speed of a CD without changing the tempo. While it's true that a piano roll and a CD are both forms of digital recordings, it is not easy to alter the speed of a CD without changing the pitch. There are, however, modern equivalents of the piano roll such as MIDI files.

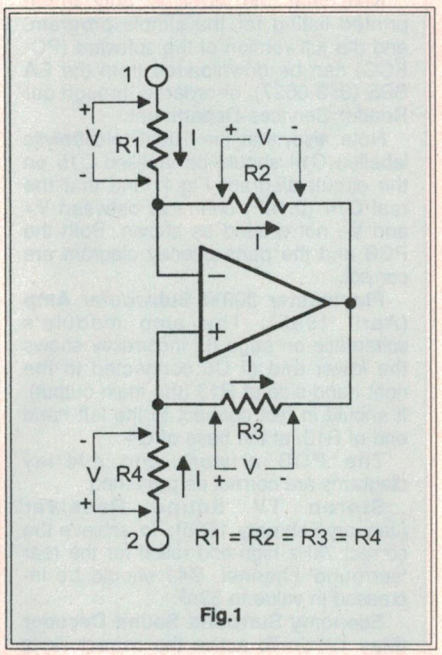


Fig.1

These files, which usually have .MID extension in the world of IBM PCs, contain information about timing and pitch in a form that allows the two to be separated quite simply. This is why a sequencer program can play these files at any speed without altering the pitch. But the information recorded on a CD cannot be so easily separated into timing and pitch information.

In any event, I'm not sure why the issue of keeping the pitch constant came up. The original question was how to change the speed of a CD player in the same way as can be done with a cassette player. In this age of digital signal processing, I wouldn't say that it's impossible to change the tempo without changing the pitch, but any simple means of changing the speed of a cassette player would alter the pitch. So, if changing both the tempo and the pitch is good enough when using a cassette player, why not do the same when using a CD player?

In any case, it seems this can be done. The December 1988 issue of Elektor Electronics explained all (well, a lot anyway!). According to this article it's just a matter of changing the frequency of the master clock. They mentioned an 11.2896MHz clock and said that this could be varied by well over +/-10%. They also presented a very ambitious design for a circuit to achieve this, although they admitted that a much simpler circuit would suffice if the speed did not have to be rock steady. (A. Wood, Sydney NSW.)

I agree that pitch variation is not a major issue, and I mentioned it out of interest. As you say, a MIDI file allows pitch variation or speed variation, without one affecting the other, but as you also say, this is a different format from the way information is stored on a CD. Our next and final letter on this topic has a more lateral approach to the problem.

I am writing in response to Alan Boulton's query about a variable speed CD player. After reading the letter from Gary Watts about the difficulties in modifying a standard CD player, I wondered if it might be more practical to record the music on a computer as a .WAV file (there are a number of programs which can be used to do this), and to use a program to read the information and play it back at a variable rate.

I don't know if any commercial programs have such a capability, but I have heard of a Sound Blaster Developer Kit for audio programming. I also realise a computer may not be practical for a dance studio, but perhaps the idea could be of interest to someone. (Mark Wallis, Rockhampton Qld.)

Thanks Mark, and to everyone who has contributed to this discussion. The idea of digitally recording the information into a computer, and using software to vary the playback speed, seems reasonable.

The main problem might be the size of the file for a complete dance number. I can't recall the name of IBM or Mac software that does this, but I remember

playing with this sort of thing a few years ago where the sampling frequency was varied on playback to change the speed.

Dry cell charger

Here's two letters about the dry cell battery charger presented in January. The first writer is not exactly complimentary about the charger or the magazine:

I am writing in great anger. Having successfully built the dry cell charger described in January, I charged a few batteries before deciding to carry out your suggested tests for current values. I did not get very far before the thing went kaput. I have not got around to checking components yet, but I suspect a couple of transistors and the IC will be dead.

This is not the first time I have had this trouble with projects from your magazine, and it has always been through using your suggested testing methods. For example I completed the ETI 162 power supply not long ago. Everything worked fine until I tried to set up the current output using the described method, that is a short circuit across the output terminals. That was it, away went Q1, IC301 and a whole range of components. I replaced these, but up they went again.

I then thought I would put a meter across the terminals and try again. This was fine until I approached the 1A setting. By now it was getting sickening as I had replaced the components five times, so I decided to seek some experienced help. The chap looked at the project and the method of setting the current range and, to quote his exact words, said "they are talking bulldust. It will blow up every time you try that."

The project has lain in a cupboard ever since, until I can pluck up enough courage to try again. There have been other projects, but I will not go into details. The failure has always come from the testing method. By the way, it takes me an hour's train ride to get replacement parts, making it expensive and very wearing.

I think I will go over to the other magazine to see if they can do any better. Incidentally, I agree with the findings of the ABC program 'The Investigators' about recharging dry cells. (W. Brain, Sunbury, Vic.)

I am at a loss to explain how the suggested testing technique of the dry cell battery charger can cause its demise, particularly if it was working in the first place. After all, the method is to simply take a measurement across a resistor while it's charging a D cell.

To date a lot of kits for the charger have been sold, and yours is the first letter I have received detailing any problems. The design was thoroughly researched and extensively tested. If yours has failed, it is not because of the testing method.

Regarding the effectiveness of recharging dry cells, I presented a detailed account of my research into this in the March 1995 edition of EA. I cannot agree with you that the findings given by the program 'The Investigators' are correct. I found there is much to be gained from recharging alkaline cells.

The ETI 162 power supply is a 1982 design, and I could not find details of the circuit. I'm therefore unable to comment about your difficulties, but I am wondering why you repeated the test five times.

It's possible you had a problem in the current limit section of the supply, which might explain why it burnt out components with a short circuit test. Without having the circuit details or the original article, I can't tell whether the described testing procedure was 'bulldust' or not. However, any regulated power supply should be able to withstand a short circuit test and I would be surprised if the ETI 162 design cannot do this.

Dry cell tester

The next letter seeks advice on how to test a dry cell, and also presents a few points I have always suspected to be true...

Having made your battery charger from the January '95 issue, I now want to build a battery tester into the unit. There is one in my multimeter, but I have been unable to decipher the circuit. Could you suggest a design for 1.5V and 9V batteries?

I have followed your articles, especially the May '95 review of the Greencell Regenerator. When I started experimenting with your design, I asked family and friends for batteries to charge. Without exception, these people could not give a tinker's damn about their batteries and if any of them had purchased a Regenerator, it would have been a waste of money, as they would have let the batteries discharge to a point where they could not be recharged. (Bernard Swan, Burwood, Vic.)

You give evidence to my long held belief that dry cell recharging will not take on in a big way. Most people are either too busy, too disorganised or are just not interested. It's far easier to buy new cells and chuck out the old...

Concerning a tester, you may not have read my article in the March '95 issue about recharging dry cells. One of the conclusions I came to is that the best point to recharge a battery is when its loaded terminal voltage is around 1.1 to 1.2V. Therefore, a simple battery tester needs to apply a load to the cell, and to indicate if the voltage is around these values.

An ideal load is a lamp, and the voltage indicator could be a voltmeter or anything that indicates the cell voltage. For example, a simple window comparator with three LEDs — red for below 1.1V, orange for between 1.1 and 1.2V and green for above 1.2V. If there's enough interest, I might design a suitable dry cell tester. Let me know.

What??

I'm borrowing again from the book *101 Puzzles in Thought and Logic* by C.R. Wylie Jnr. The question, which I've modified somewhat is: Among 100 applicants for a certain technical position, it was found that 10 had never studied either analog or digital electronics. Seventy five of the applicants had qualifications in analog electronics, and 83 had qualifications in digital electronics.

How many applicants had qualifications in both analog and digital electronics?

Answer to August What??

Since the entire network is resistive, we can conclude that the final element will also be resistive. Assume a voltage V is present across R1. The current in this resistor must also flow through R2 (as none flows into the op amp's input) developing the same voltage across R2. The output of the op amp will therefore have a value of -V compared to the inverting input.

Because the voltage between the input terminals of the op amp is zero (by feedback action), the voltage across R3 will also equal V, negative at the output side. Therefore a current flows through R3, from R4, into the output terminal of the op amp. The circuit conditions are shown in Fig.1.

The potential between nodes 1 and 2 is 0V, and yet current is flowing into the circuit from both nodes. Therefore, as a current is flowing without a voltage, the circuit must be a negative resistance. The current in all parts equals V/R (R = R1 = R2 = R3 = R4), so we can say that the value of the negative resistor is - R. ❖

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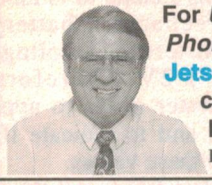
ALTRONICS



For *Ultra Quick* delivery
Phone Order on 1-800 999 007.
Jetservice Delivery - next day all capital cities and suburbs, please add 24 - 48 hours for country clients.
Regards, **Jack O'Donnell**, Managing Director

Guitar Headphone Amplifier Kit

(See SC May '95) Now you can practice your guitar at any time by using this low cost amplifier. It provides ample power for headphones so that you can play to your heart's content without disturbing the rest of the household or your neighbours. Simply plug in your guitar, headphones and a 12V AC power supply (not included).

Practice Your Guitar at any Time by Using this Low Cost Headphone Amplifier!

K 5537 **$29.95**

M 9120 12V AC Plugpack to Suit **$12.95**

Gain Controlled Microphone Preamp Kit

(See SC Aug '95) Designed for use with PA systems this unit simply plugs in between your balanced microphone and amplifier. It will monitor the microphone input level, and adjust the volume to maintain a constant output level. This will ensure that the amplified sound level is always the same, regardless as to how loudly (or softly) a person speaks. Includes an XLR type socket for a balanced microphone input, and an unbalanced 6.35mm output socket. Requires 9V DC power supply (not included).

Features: • Low Distortion • Fast Response Time

NEW

K 5520 **$29.95**

M 9105 9V DC Plugpack to Suit **$10.95**

High Capacity Fast Charger for Nicad Batteries Kit

(See SC Jan '91) This charger is designed to operate from a 12V battery. It can charge 6V to 12V nicad battery packs at up to 6A, or you can custom wire the unit to charge battery packs up to 30V at a reduced current. In operation the circuit will recharge a typical nicad racing pack in about 20 minutes. **Features:** • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6-12V • Fully punched and screened front panel • State of the art digital circuitry

K 1660 Normally $129.00, **This Month Only $99**

Heavy-Duty 5A Drill Speed Controller Kit

Great for the Handyman!

(See SC Sep '92) This speed controller can be used with power tools rated up to 5 amps. Use it to control the speed of circular saws, electric drills, lawn edgers and other appliances with universal "brush type" motors.

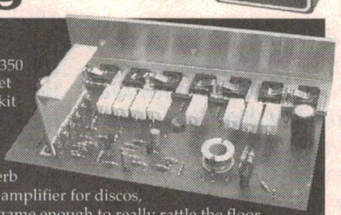
K 6010 **$49.95**

16 Second Message Recorder Kit

(See SC July '93) This is an interesting kit that makes use of new technology to record audio signals. Whilst most recorders store the audio in digital form and thus require back up power, the IC in this kit stores the signal in analog form and can retain the information for up to 10 years. Can store one message of up to 16 seconds. Simple Record and Playback pushbutton operation. Kit includes speaker, professional screen printed front panel etc.

K 9560 $69.95, **This Month Only $49**

350W Amp Module Kit

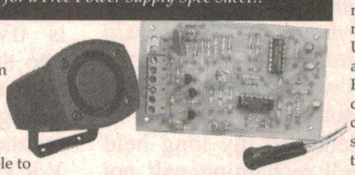


This fantastic amplifier will deliver a massive 350 watts RMS into 4 ohms. Using the latest mosfet technology and circuit design techniques this kit is supplied as a basic module, which makes it ideal to be built into subwoofer enclosures, juke boxes and mixers etc. Housed in a suitable enclosure this kit will make a simple superb mono or stereo (using 2 modules) high power amplifier for discos, public address or even in the home if you are game enough to really rattle the floor boards!

K 5180 **$189**

Call Us for a Free Power Supply Spec Sheet!!

Screecher Car Alarm Kit



(See EA Aug '86) Here is a low cost car alarm designed with a new deterrent strategy. Instead of using the alarm to try and draw attention of passers-by to the felony in progress, this alarm sounds inside the car to deafen the thief and make it too uncomfortable to proceed. Makes an ideal second/back-up alarm. Deafening 110dB Modulated Tone. Two sensor inputs - Normally open and normally closed enable simple connection to door, bonnet, boot light, switches etc.

K 4360 Normally $49.50, **This Month Only $39**

Bargain-Priced Surround Sound Decoder Kits

Build one of these surround sound simulators and envelope yourself with the stunning realism and dramatic sound impact available from surround encoded videos and TV transmissions.

Short-Form Version

Be Quick - Only 46 Left!

(See EA Jan '92) Supplied as a circuit board with components only, this version is ideal for those who are on a budget or want to built the unit into an amplifier or TV etc. Requires ±18 to ±24 volt DC (or higher with adequate heatsinking) power supply (not included).

K 5585 **$39.95**

Full Self Contained Version

NEW

(See EA May '95) New and improved version features re-designed circuitry. Supplied with a case, transformer input/output sockets and high quality silk screened and punched panels - no complicated holes to drill or file. Simple to build and connect.

K 5588 **$69.95**

DiscoLite Chaser & Colour Organ Kit

(See SC July/Aug '88) The Discolite flashes party lights on and off in beat with music from your amplifier. **Features:** • 4 light channels controlled by 4 separate audio channels • Forward reverse and auto-reversing chaser patterns • Simultaneous strobe on all four channels • Alternating light patterns • Music modulation available on chaser strobe and alternate patterns • Inbuilt microphone or direct inputs for beat triggering or audio modulation of lights • Sensitivity control • Individually pre-settable sensitivity levels for each channel • Front panel LEDs mimic light display • Altronics Kit pre-punched and silk screened

K 5805 **$159.50**

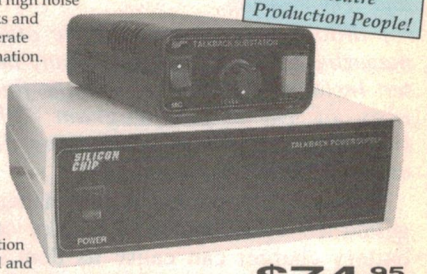
40 Volt 3 Amp Variable Power Supply Kit

(See SC Jan/Feb '94) This 1.23 V to 40 V adjustable power supply is designed for heavy-duty work. It uses a high efficiency switching regulator circuit. Features preset voltage and current limiting, full overload protection (with indicators) and an LCD panel meter for precise voltage and current readouts.

K 3330 **$239.95**

Multi-Station Headset Intercom Kit

Calling All Muso's & Theatre Production People!



(See SC June '92) This multi-station headset intercom is designed to provide clear communication in high noise environments such as at race tracks and rock concerts. It is designed to operate with a headphone and mic combination. Each headset requires a station module. Stations are simply connected in a daisy-chain fashion. Up to 12 units (stations) can operate from one power supply. Features low noise circuity and compares favourably to commercial equivalents. Mics can be switched on continuously (even at the one time) for hands free operation of all stations. Also includes visual and audio call function. Ideally suited to our C 9055 headset mic and the C 9070 noise attenuating Aviation Headset.

K 5250 Station Module **$74.95**

K 5255 Power Supply **$64.95**

1-800 999 007 **PERTH (09) 328 1599**

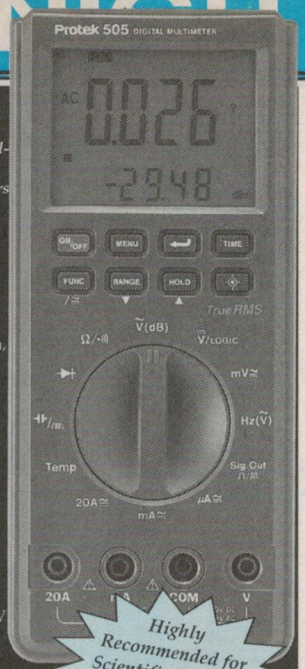
Doc.JH315

OVERNIGHT DELIVERY

ALTRONICS

Fax Order Line: (09) 328 3487

True RMS Digital Multimeter



Supplied with high quality hard carry case and silicon test leads. This 3.75 digit 4000 count digital multimeter would have to be one of the best meters we have seen. Features include menu driven functions (no complicated instructions to remember), large backlit display, timer function, 20 amp current scale and many more.

Other Features: • True RMS mode • Large display includes main and sub displays with bargraph • 10 Location memory • Stop watch/presettable count down timer • Minimum, maximum, average and relative modes • Decibel measurement • Capacitance and inductance measurement • Temperature mode (°C and °F) • Pulse signal generator for logic and audible testing etc • Continuity and diode test • Logic test • Auto power "off" and "keep on" mode • 20A current range • Warning buzzer sounds when leads are incorrectly inserted in the 20A current mode • Back lit display • Data hold and run mode • Low battery indication • Overload protection • Safety design in compliance with UL 1244 and VDE0411

Specifications:

DC Voltage Ranges:..400mV, 4V, 40V, 400V, 1000V
AC Voltage Ranges:..4V, 40V, 400V, 750V
DC Current Ranges:..400µA, 400mA, 20A
AC Current Ranges: .400µA, 400mA, 20A
Frequency Ranges:....10kHz, 100kHz, 1MHz, 10MHz
Resistance Ranges:....400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ
Capacitance Range:...100µF
Inductance Range: 100H
Temperate Ranges: ...-17° - 1093° C (0° - 2000° F)
Display:.....3.75 digit, 4000 count LCD

Highly Recommended for Scientific Research & Development Work

Q 1091 **$229**

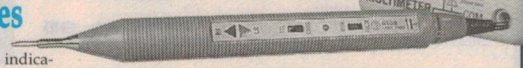
19 Range Digital Multimeter

Amazing Meter for Under $30!

After evaluating 30 or more meters of this calibre we found the Q 1053 to be the best value for money by far! This 3.5 digit multimeter features a 19 position, easy to use rotary switch for function and range position. Includes AC/DC voltage check, 10A DC current, resistance, diode and a transistor test function. This meter offers many of the features of much more expensive models but at the fraction of the cost. Ideal for the cash strapped student, or budding enthusiast!

Q 1053 Normally $39.95, **This Month Only $29.95**

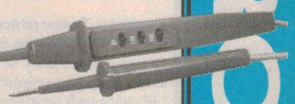
Logic Probes



Features audio and visual 'hi' and 'low' indication. Detects pulsing signals down to 30ns pulse duration. TTL and CMOS compatibility at the flick of a switch. Makes observation and fault finding of any digital circuit easy!

Q 1272 20MHz Logic Probe **$39.95**

AC/DC Low Voltage Test Probe



Ideally suited for tracing or locating voltages up to 24V AC or DC. Excellent for working on cars, boats or trucks electrical systems. Simply place one probe to earth and place the other probe onto the wire to be checked. If voltage is available the corresponding (6, 12 or 24V) LED will light. Very simple to use.

Q 1230 **$7.25**

Super Compact Car / Motorcycle Alarm

Exclusive to Altronics

Super compact in size, this alarm features shock sensor (with adjustable sensitivity), voltage drop sensing (can be disabled) and negative trigger input (for door, boot and bonnet etc). Wireless remote control with arm/disarm and panic functions. Will flash car indicators or park lights when arming and disarming. All the electronics and piezo siren are housed inside one neat enclosure measuring only 100L x 75W x 45H mm, making it ideal for cars and motorbikes. Supplied complete with a flashing dash mounted LED and wiring harness.

Protect your car from theft. Install one of these alarms & save hundreds $$$ on comparable systems!

Features: • Remote controlled (≈15m range) • 110dB piezo siren built into controller • Very compact size • Voltage drop sensing circuit (selectable) • Audible arming / disarming with trigger indicator • Built in adjustable shock sensor • Remote panic • Negative trigger input • Triggered memory • 30 second reset and rearm after triggering • 25 second arming delay • 10mA current draw in armed mode

S 5210 Alarm Only **$99**

S 5211 Additional Remote Control **$16.95**

High Power 6 Tone Sirens

Massive 120dB Output!

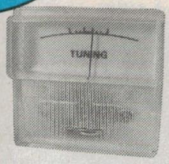
Continuously cycles through 6 different alarm sounds, each of 6 seconds duration. Each tone can be enabled/disabled via internal DIP switches. Certainly attracts some attention! Requires 12V DC at 1.2A. Dimensions ≈80mm Ø by ≈80mm Long (excluding the bracket).

Scoop Purchase! Normally $39.95 Save Over 50%

Hurry, Stocks are Strictly Limited at This Price

S 6134 **$19.95**

Tuning Meter with Centre Zero



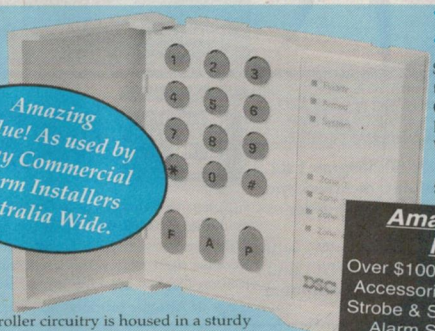
We have a limited quantity of tuning meters. Their sensitivity is 250µA half scale. You will need to be quick at this price. Ideal for project radios etc. Hurry stocks limited.

Q 0600 Normally $5.95, **This Month $3.00**

Altronics Retail Store Perth Now Open Extended Hours

Saturday - 8:30am to 5:00pm
Sunday - 12:00pm to 5:00pm

Professional 4 Sector Digital Alarm System with Auto Dialler



Amazing Value! As used by Many Commercial Alarm Installers Australia Wide.

This alarm panel is the same type as used by many commercial alarm companies to protect both residential and commercial properties.

Incorporating an inbuilt Austel approved auto-dialler, this great alarm can be configured to automatically dial two preset numbers in the event of an alarm, i.e. could be configured to automatically ring a neighbour or an alarm monitoring company. The main controller circuitry is housed in a sturdy steel cabinet. Provision is made to house an optional back up battery if required. The keypad control unit is generally located at the front door for easy access to arming and disarming of the system. The entire system is controlled and programmed via this keypad. Virtually any type of sensor can be used with this system. A combination of normally open and normally closed sensors can be used on any zone. Each zone is monitored by end of line resistors to maintain system integrity, i.e. if someone interferes with the system wiring the alarm will sound immediately.

Features: • master code and three adjustable user codes • monitor function which test features like battery backup and mains failure • four individually programmable sectors with a large array of functions available • all four sectors utilise extensive noise protection circuitry and end of line resistors for added security • once triggered the alarm has the option of a silent alarm, and dialling a friend or monitoring company • quick arming option • zone bypassing for sectors which are false triggering • bell test - to test the external sirens without dialling out • door chime mode for entry/exit paths • battery backup • home or away operation • accessible alarm memory for confirming which sectors were triggered • separate instruction and installation manuals • 12 months warranty

S 5490 **$299**

M 9140 16V AC Plug Pack with Earth to Suit **$32**
S 5065 12V 1.2AH Backup Battery to Suit **$32.50**

PIR Movement Detector

5 Year Warranty

Small and sleek this detector is ideal for the home or the office. Range up to 13 x 13m. **Features:** • LED On/Off Jumper • Vertical Adjustment • Wall/Corner Mounting • Small Size - 62w x 88h x 48d mm • 5 Year Warranty

S 5307 **$49**

Ideal for the S 5490 Alarm Opposite

Amazing Bonus Package

Over $100 Value of Installation Accessories Including Cable, Strobe & Siren Free with Each Alarm System Purchase!

50 Metres of High Quality 4Core Security Cable (Sufficient for average 4 bedroom house). W 0356

High Intensity Strobe S 5445

Siren Horn C 2015

2 Large Alarm Stickers - S 5400
Plus 4 Window Stickers - S 5410

1-800 999 007 PERTH (09) 328 1599

Doc.JH315

ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (09) 328 3487

Professional Gas Iron Kit

Save Over 30%

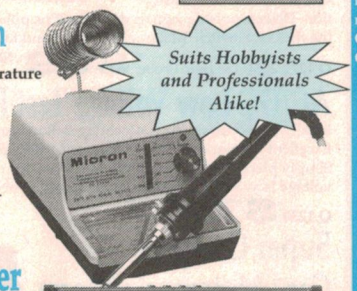
The advanced *CADIK* Soldering Iron offers a convenience and a range of functions that redefine the limits of soldering. This kit consists of the *CADIK* Gas Soldering Iron supplied in a handy carry case with a range of tips and accessories.

Features: • See through gas chamber • Built in ignition cap • Uses standard butane gas • Supplied with safety stand, cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter

T 2502 Normally $74.95, **This Month Only** **$49.95**

Limited to 100 Units Only at This Price!

Micron Soldering Station



Suits Hobbyists and Professionals Alike!

Electronic Temperature Controlled, Temperature Selectable, Soldering Station

Features heavy duty 60 watt element, variable temperature control (320° to 440°C), LED bargraph temperature readout, quality silicon lead, light weight handle, sponge tray, and super heavy duty iron clad tips etc. Range of tip sizes available.

T 2440 **$169.95**

4 Channel Economy Mixer

This compact mixer has inputs suitable for microphone, record players, camera audio, CD, Tape, and Tuner etc. Ideal for amateur cinematographers who would like to add their own background music and/or voice overs. Includes inputs for microphone, phono (with magnetic or ceramic cartridge), camera audio and an auxiliary (CD, tape, tuner etc). Features headphone output and master volume control. Requires

A 2520 Normally $119.00, **This Month Only** **$99**

M 9004 9V DC 300mA Plug Pack to Suit **$10.95**

Nibbling Tool

Buy Both for ***$39*** *and Save Over 15%*

For steel, plastic and aluminium. Capacity: 1mm for steel, and 1.6mm for aluminium, Ideal for the hobbyist and technician who want a professional appearance for their projects.

T 2355 Normally $21.95

Tapered Reamer

Give Your Projects that Professional Look!

Used for enlarging holes from 5mm to 20mm in plastic, aluminium and sheet metal.

T 2370 Normally $34.90

Weather Proof Sound Monitors

Save a Massive $120

Ideal for Hi-Fi extension, surround sound or outdoor use. 8 Ohm 30 Watts.

Features: • Rugged UV stabilised 'Luran S' moulded enclosure • Engineer designed in Australia • Excellent reproduction • Superior to imports - yet a fraction of the price • All exterior fixings marine grade stainless steel • Speaker cones treated with special formula to repel moisture Dimensions 155W x 115D x 230H mm

C 0904 White
C 0905 Black

Normally $160 ea
This Month Only
$199 pair

"Compared more than favourably in performance and looks to expensive imports costing twice as much". John Negus - Leading WA Audiophile.

Includes Unique 'Wacki' Mounting Bracket

Stereo 60 Watt 8 Ohm Attenuator

Fully self contained on a single gang switch plate. Supplied with mounting block. Complete with wiring instructions. Ideal for patio, Hi-Fi extension speakers etc.

A 2300 **$49.95**

Aviation Headset

Now Supplied With Doubled Cushioned Headband for Extra Comfort!

This Month Receive a FREE Carry Case Valued at $19.95 Limited to First 100 Callers

1000's Sold Across Australia-Includes 2 Year Warranty!

It was not to long ago when spending $450.00 on an Aviation Headset was not uncommon. Altronics changed all that when we released our C 9070 Aviation Headset for $199.00. Add to this enhanced microphone, improved lead shielding and headband comfort these headsets must be the best value for money in Australia!

C 9070 **$199**

This Month Receive a FREE Carry Case Valued at $19.95 - Limited to First 100 Callers

Altronic Dealers Wanted

If you have a dynamic electronics business and would like to sell Altronic Products and Components - We would like to hear from you!

Contact Greg Liddelow at Altronic Distributors Wholesale on (09) 328 2199.

ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 3487
MAIL ORDERS C/- P.O. Box 8350
Perth Business Centre, W.A. 6849

We welcome ... bankcard MasterCard VISA

Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $10.00, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

WA - COUNTRY		
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	Micro Electronics	(098) 412077
BUNBURY	Micro Electronics	(097) 216222
ESPERANCE	Esperance Comm.	(090) 713344
PORT HEDLAND	Ivan Tomek Electronics	(091) 732531
ROCKINGHAM	TV Joe's	(09) 5271806
VIC - CITY		
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CHELTENHAM	Talking Electronics	(03) 5842386
CLAYTON	TECS ●	(03) 5629501
CROYDON	Truscott Electronics ●	(03) 7233860
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WARNERS BAY	Vilec Distributors	(049) 566792
WOLLONGONG	Newtek Electronics ●	(042) 271620
	Vimcom Electronics	(042) 284400

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Doc.JH315

SHORTWAVE LISTENING

with Arthur Cushen, MBE

Relay bases get closer to the audience

In recent years there have been a number of relay bases built in strategic locations nearer the primary audience. Also popular is a system of exchanging programme time between international broadcasters.

During the Cold War, the western powers were keen to put stronger signals into eastern Europe. To accomplish this they established 'relay bases' which more or less circled the former Soviet Union. Not only was it a matter of trying to get a signal into eastern Europe, but of major concern was to overcome the jamming which was hurled at the incoming signal.

One of the early relay bases was in Portugal, where a private company established a base which was hired out to broadcasters. More and more countries realised that it was better to build their own relay stations, which would operate at the hours suitable to reach the target audience.

International broadcasters looked for countries which had a stable government and where they could buy or lease the land in order to construct relay facilities. They also had to be aware of the frequencies assigned to that country, so that they would use the channels which would be allocated to the area.

In the case of Britain, the BBC looked to former colonies and this meant the establishment of relay bases in Ascension, Antigua, Oman, Seychelles, Singapore and Hong Kong.

Today a new BBC relay base is under construction in Thailand. This consists of four 250kW transmitters located at Nakhon Sawan, 240km north of Bangkok. The base should be operational in 1996 and has been built to replace Hong Kong, whose future is not known when China takes over in 1997.

The BBC also has many exchange arrangements, and its programmes are carried by the Voice of America, and Radio Canada, while in Britain Radio Japan is relayed for reception in Europe.

The Voice of America, as well as using many transmitting sites in the United States, has built relay bases in Botswana, Morocco, Germany, Kuwait, Sri Lanka, the Philippines and Thailand. The latter is the latest base to be put into operation, and consists of seven 500kW transmitters located at Udon.

Radio Nederland first built its relay base in Bonaire in 1968, followed by one in Madagascar. Then the facilities in Holland were upgraded to Flevo, and in recent months, they have leased time on seven transmitters in the former Soviet Union.

There are many other countries which have established relay bases overseas, including France, Germany and Spain. The many religious stations have extended into this field, and are operating relay stations on all continents.

The use of satellites has enabled high quality reception of signals at these distant relay points as they are received from the broadcasting studio from where the programmes are transmitted.

An increasing number of European countries have their programmes available on satellite for domestic reception, while others are using a cable system to reach their local audience.

Computer users world wide can also reach programme information from various stations on the Internet.

Answering enquiries

The many enquiries received from listeners throughout Australia and New Zealand from this page mainly concern two points of interest. The questions are whether there is a radio club in operation, and if there is a book written for the new listener.

Most radio clubs in this area are under the umbrella organisation of the South Pacific Association of Radio Clubs and a complete list of these clubs and their activities is available from the writer.

The question of a suitable publication is covered by a book recently published by the writer based on his 57 years of listening, under the title *Arthur Cushen's Radio Listener's Guide.*

It covers 124 pages and is a top quality production, A4 size with over 150 photos. It's also available to Electronics Australia readers at the special price of $10 Australian from 212 Earn Street, Invercargill, NZ. ❖

AROUND THE WORLD

ALASKA: KNLS, Anchor Point gives a new English schedule from September 24, 1995 to March 31, 1996: 0800 - 0900UTC on 6150kHz; 1300 - 1400 7365kHz.
Broadcasts are 0800 - 1800 with other languages being Mandarin and Russian.

ALBANIA: Radio Tirana has greatly reduced its output and now only broadcasts in English from 1600 - 1615 on 7155 and 9760kHz; from 1830 - 1900, 7260 and 9720kHz beamed to Europe; a service to North America at 0145 - 0200, on 6145, 7160kHz; and 0230 - 0300 on the same frequencies.

CANADA: RCI, Montreal is relaying the domestic CBC programme on Saturdays and Sundays, heard at 2200 - 2300 on the unlisted frequency of 7195kHz.

CHINA: Radio China International, broadcasting in English at 0400UTC on 9650kHz, blocks out the reception of the Voice of Peace, Ethipia, also heard on the channel.

CROATIA: Radio Croatia, Zagreb, has a new 100kW transmitter located at Deanovec, near Zagreb, with financial help from Croatians overseas. The transmitter relays the domestic programme from Zagreb: 1300 - 1700 on 13,640kHz; 1700 - 2100, on 11,630kHz; and 2100 - 1330UTC on 7370kHz. English news is scheduled at 0704, 0904, 1304 and 2303. In this area 7370kHz has been heard with news in English at 0300 and 0400UTC.

GREECE: Athens, broadcasts to North America 000 - 0350 including English news at 0130 and 0340UTC on 6260, 7448 and 9935kHz; to Australia in English and Greek at 0600 - 0800 on 9375, 9425 and 11,645kHz; 2100 - 2200 on 6260; and 2200 - 2250 on 6260 and 9375kHz.

NORWAY: Oslo has dropped 15,170kHz and replaced it with 7295kHz at 0600 - 0630UTC to New Zealand. English is broadcast on Sundays.

SWEDEN: Stockholm has been heard in English at 0330 - 0400UTC on 9850kHz.

USA: WHRI, South Bend, Indiana, is now using the new frequency of 5745kHz which includes World of Radio on Saturday at 0500 - 0530 UTC. The programme is also available on 9495kHz.

VIETNAM: The Voice of Vietnam, Hanoi has broadcasts in English at 1000 - 1030 on 9580, 15,009kHz; at 1100 - 1130 on 7285, 9730kHz; at 1230 - 1300 on 9840, 15,009kHz; and 1330 - 1400, 1600 - 1630, 1800 - 1830, 1900 - 1930, 2030 - 2100, 2330 - 2400, all on 9840 and 15,009kHz.

YUGOSLAVIA: Belgrade's English broadcasts to Africa on 9720kHz have been well received at 1830 - 1900UTC. The programme is also available on 6100kHz. ❖

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.

AUTOMOTIVE ELECTRONICS

with NICK de VRIES MIAME, AMSAE, FI Diag.E.

OTC's Vision handheld diagnostic tool

In last month's column, I promised to show some editorial independance by conducting a 'back to back' review of a similar handheld testing product. Here it is: this month we take a look at the OTC Vision, another new 'Lab Scope and Digital Multimeter' for automotive testing and fault diagnosis...

The Owatonna Tool Company falls under the SPX Automotive Group corporate umbrella, which includes some of the best known names in the industry such as Kent-Moore, Litchfield, Ritch and Robinair.

I had a brief encounter with OTC's new 'Vision' at the Automotive Trade Fair in May, and more recently I was privileged to borrow the personal demonstrator unit of Mark Psaila, OTC's South Australian State Sales Manager, for a few days so that I could run a full-blown test.

When I collected the Vision scope, the overall impression was of a well-presented piece of kit — housed as it was in a protectively padded glove, and supplied with a soft-sided compartmentalised carry-all for stowing the unit and its accessories.

A section in the carry-all lid houses the two manuals, which I found informative and well laid out. The 'Waveform Manual' gives examples of the different sensors and actuators found in the automotive environment, along with various hints on the best way to capture the signals and explanations of the 'whys and wherefores' of some of the apparent idiosyncrasies.

First impressions

The first thing that struck me about the Vision itself was the simplicity of the keypad layout. The 12 tactile 'soft keys' are laid out neatly, in a way to make the operation as intuitive as possible and to save the user having to continually search for the right key.

This must be one of the most difficult areas for the marketing and engineering departments of any electronic product manufacturer to come to grips with. On the one hand, the marketing people want a simple looking set of keys, so as not to give the impression of excessive complexity.

On the other hand the engineering boffins do need a finite minimum, or the darn thing won't work!

Another example of some clear thinking on the part of the design team is the colour coordinated leads and input sockets. This feature goes beyond just aesthetics and simplicity, to the software itself — which refers the operator to the appropriate lead colour in the multimeter and scope tests to avoid unnecessary confusion.

I particularly liked the test lead clips, made by J.S. Popper Inc. of Little Ferry, New Jersey. They must be the most well thought out set of clips in the industry, with moulded insulation boots, several different ways of gripping or piercing the terminal or wire — plus a solid banana socket entry point at the back of the clip, for the test lead.

Switching it on

Like most people I suppose, there is an element of arrogance in me that says 'I can do anything'. So a tool or machine that encourages the user to believe they will be competent with the product by way of the controls or operating system supplied, in a relatively short time, is going to do well in the marketplace.

Upon pressing the PWR button, a 'beep' lets you know that things are under way and the title screen comes up displaying the corporate logo and the usual 'All rights reserved' guff, at the bottom of the screen.

The ENTER key seems to be the next most obvious direction, for this particular 'read the manual last' type person, and sure enough doing this causes the Main

Menu appears with four items to choose from.

Fig.1 gives us an indication of the speed of change in the software driven test equipment market. Although the Instruction Manual is dated 1/95, the software has already changed. (It seems the one thing you can depend on, in the world of software, is change.) The Main Selection (now Main Menu) screen now has a UTILITY option alongside AUTO METERS, which balances the display nicely.

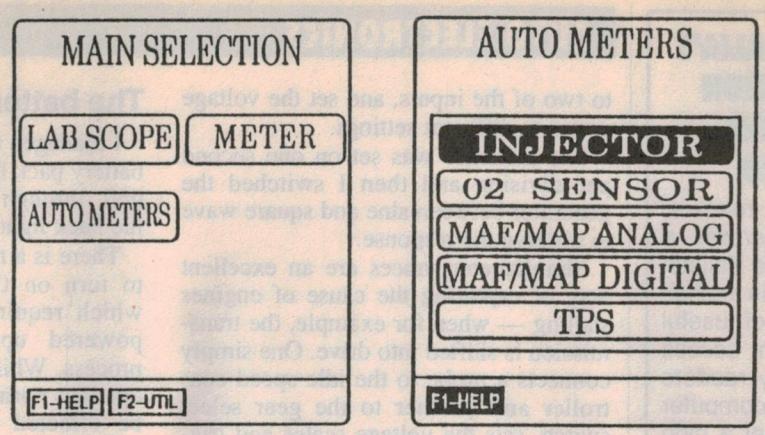

Fig.1: The Main Selection and Auto Meters menus. Navigating your way around the tests is quite straightforward, thanks to the vision's friendly menu system.

Auto Meters

The AUTO METERS function looked interesting, and turns out to be five dedicated test pages to provide the technician with the quickest means of determining the condition of a component or circuit, based on a proven set of test parameters applicable to the most common systems.

As my VP Commodore is fitted with an oxygen sensor, I thought it would make an ideal test point to start off this review. So it was out with the razor blades, to slit the protective sleeving off the wiring loom (the newness is definitely wearing off this car). Then I attached a piercing probe to the O_2 sensor wire (there goes some more of that newness).

The accompanying manual does make mention in numerous places of the need to use the 10-megohm lead for O_2 sensor testing, which goes to show that reading the manual can save time and frustration sometimes.

What the manual doesn't explain is the reasons *behind* their insistence — which, as most Lab Scope users will undoubtably already know, is that the input impedance of most oscilloscopes is only one megohm.

The software expects you to connect the correct probe to reduce the loading effect on low current O_2 sensors, and provides the correct voltage scaling in the O_2 Sensor Meter mode for the x10 probe. But I digress...

Back to the story. Driving a car and taking measurements at the same time is definitely not for the faint hearted! It was interesting to discover however, that from a cold start, it took about two kilometres for the closed-loop circuitry to come into play on a wintry morning, and while the Vision's ever-ready F1 help screen made mention of systems capable of over 100 cross counts per five-second period, the highest my Delco system managed was about 37 at high engine speeds.

A cross count?

What's a 'cross count', do I hear? I thought you'd never ask!

The ECU typically takes in the 0 to 1V analog output from the EGO sensor and feeds it through a pair of comparators, to convert it to a digital HI-LO signal that the processor can deal with. According to the Waveform Manual, the ECU interprets a voltage higher than 0.6 volts as a rich mixture and voltages under 0.3 volts as a lean mixture. Fig.2 is the Instruction Manual's illustration of the Vision's O_2 Sensor Meter display, showing you a cross count reading of 81. Every time the EGO signal crosses the 0.45V DC line (about its mid point) in either direction, the Vision counts 'one crossing' and adds it to the tally for the five-second period.

From this information the technician can determine whether the sensor is up to the job, or has become contaminated and 'lazy' in its response. (Some vehicle manufacturers quote cross counts per 10-second period, so it's as well to be aware of the different methods when comparing measurements.)

Obviously the greatest number of cross counts, the tighter the control over the fuel system by the ECU. If only we could get EGO sensors to respond as fast as the engine speed, that would mean precise fuel control for each combustion cycle — now wouldn't that be just the perfect engine?I wouldn't be surprised if further tightening of the emissions legislation will force the research for just such a device.

The lab scope

The Vision's inbuilt lab scope comprises an analog to digital converter (ADC) working at an impressive 250k samples/sec, that shares itself between the Vision's four input channels. In four-channel mode this means 62.5k samples/sec per channel. You might think this is slow, by some electronics standards, but when you keep in mind the application it looks very good — and it's still light years ahead of the 50Hz sampling of a DMM!

There are nice little additional features on the Vision like measurement cursors for 'Frequency', 'Delta Volts', and 'Delta Time', which add a measure of power to the oscilloscope functions.

As a test, while I was sitting in front of my computer writing this story, I connected the output of a function generator

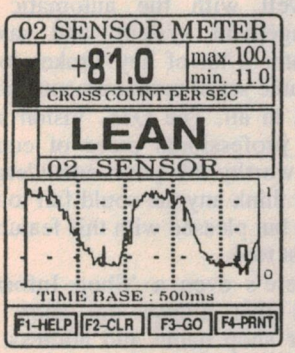

Fig.2: The comprehensive test set-up for oxygen sensors gives rapid response for a quick diagnosis.

Fig.3: A four channel multimeter is included, for 'in depth' analysis. Every auto electrician's dream!

ELECTRONICS AUSTRALIA'S READER INFORMATION SERVICE COMPUTER BULLETIN BOARD

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers equipped with a personal computer and modem. We know that a high proportion of our readers have these facilities, nowadays.

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Index files for EA and ETI construction projects
- Recent notes and errata, both published and as-yet unpublished
- Useful public domain and 'shareware' software for electronics and amateur radio applications
- General interest shareware utilities, such as the commonly-used compression and decompression utilities used for efficient storage and faster file transfer.
- The ability to upload Letters to the Editor, and/or contributions to our Forum and Information Centre columns (send them as plain-text ASCII files, please!)

Soon we hope to have an on-line 'Discussion Forum' facility in operation, to allow readers to exchange useful technical information directly.

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

So feel free to call up the *Electronics Australia* BBS, and take advantage of its facilities. There is no cost for accessing the system itself, which is provided purely as a service to readers. Your only outlay will be the usual cost for a phone call to Sydney...

to two of the inputs, and set the voltage scales to different settings.

The timebase was set on one second per division and then I switched the generator between sine and square wave to observe the response.

Simultaneous traces are an excellent way of capturing the cause of engines stalling — when for example, the transmission is shifted into drive. One simply connects a probe to the idle speed controller and another to the gear select switch, sets the voltage scales and trigger point to a suitable level and reproduce the fault.

The time delay between gear selection and the ECU command to raise the engine speed can in some cases be too long, and the engine stalls.

Wherever there is a 'cause and effect' type of fault, a triggered multi-trace oscilloscope will always have a diagnostic role in the modern motor car.

Multiple multimeters

A four-channel multimeter is another powerful feature of the OTC Vision. Selections can be made to display up to six measurements from a possible combination of 24 different readings (see Fig.3). Click on the 'Probe' applet, and a panel opens for a choice of 'SCOPE' or 'O_2' (x10) probes.

I was having trouble with a remote door lock transmitter, so the obvious thing to do while I had the Vision tool was to measure its battery under load. I chose three parameters — Vmin, Vmax, and Vavg — just to get a feel for it, and sure enough there was only 10.9 volts under load vs 11.5V for no load. Definitely only 'V-avg', wouldn't you say?

Expansion

Soon to come, for use with the OTC Vision, are a primary and secondary ignition lead set and a scan tool software/module, to combine the features of the well-known Monitor 4000E data scanner with the ability to view the cause of the fault codes, all in the one tool.

Another upgrade is the ability to interconnect the Vision with the OTC Four-Gas Analyser, that is already an option for the Monitor 4000E. It will be interesting to see how the larger screen displays the gas readings, as there will be room for some enhancements. By the time you read this article (I wrote it at the end of June), these upgrades could well be on the market.

The battery pack

I managed to flatten the Vision's 7.2V battery pack twice during my loan of the unit, through almost constant use with the back light switched on.

There is a menu item under UTILITY to turn on the 'Fast Charge' feature, which requires you to leave the unit powered up during the recharging process. While in this mode, the Vision operates normally, and fast charging can be effected from any 7.5-16.0V DC source such as the optional AC/DC charger — or a car battery, via the adaptor lead set.

Under the SELF TEST menu, a Power Test mode displays the state of the NiCad battery pack and also the charging input voltage level. This is a sort of double check for the AC/DC adaptor, or the cars' charge rate if you happen to be hooked up to a vehicle battery.

Conclusion

Overall, there were several aspects to the Vision Lab Scope that I felt were helpful to give the technician a speedier diagnosis — which is where the rubber meets the road as far as the professional is concerned.

The 'Autometer' functions I found to be convenient and concise, combining as they do the waveshape plus digital measurements on the same screen. Having a four-channel multimeter seems a bit over the top for the repair industry, but is an obvious facility to include when you already have a four-channel oscilloscope built in, using the same probes.

Each time the Vision is switched off in an operative mode, the system remembers where it was, then whenever it is powered up again the operator is back at the same spot as before. This kind of thoughtful programming works in well with the automatic power management system, and saves the operator a lot of key strokes to set up the same set of measurements next time.

All in all, The OTC Vision seems a very professional piece of equipment and worthy of your consideration. I don't think anyone could fail to be anything but pleased with this feature-packed test tool.

There's even a 'Shop Information' panel that allows the entry of the repair shop name and address, etc. to enhance the print-outs. I wonder if putting my name into it will mean I can keep this one? ❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

September, 1945

'Smithy' film: Captain P.G. Taylor, navigator of Sir Charles Kingsford-Smith's plane, Southern Cross, will play his own part in the film 'Smithy', being made by Columbia pictures.

Captain Taylor will fly the Southern Cross for the first time since its flight across the Tasman, from Sydney to New Zealand in May, 1935.

Hanging magnet: A tiny magnet which floats in the air without visible means of support is the latest device to be exhibited by Russian scientists, and reported by the USSR Academy of Science. The magnet, a bar of ferro-nickel remains suspended above a lead plate that has been cooled to 269 dgrees below zero centigrade — about four degrees above absolute zero.

The explanation is that the electrical resistance of some metals, including lead, drops greatly at very low temperatures. It is believed that the field of the magnet sets up induction currents in the lead and that these repel the magnet.

If thrown on the cold plate, the magnet bounces into the air and hangs there until the temperature of the plate rises about three degrees, when it settles on the surface.

September, 1970

Nuclear battery: A heart pacemaker, successfully implanted in a patient at London's National Heart Hospital, is powered by a nuclear battery developed by the UK Atomic Energy Authority, Harwell. The battery uses a tiny quantity of plutonium 238 sealed in a capsule a few millimetres in size.

The pacemaker is expected to last at least 10 years before a new implant is needed, compared with two years using conventional batteries.

'Quiet' mercury lamps: A mercury lamp with very low RF radiation level has been developed in Japan by Toshiba in cooperation with the central technical laboratory of the Japan Broadcasting Corporation.

Conventional discharge lamps, including fluorescent and mercury lamps, generate interference which affects radio and TV receivers. In the new mercury lamp interference strength has been reduced by about 20:1 to 30:1.

Airplane communicates via satellite: All 747s now have a bump behind the distinguishing forward dorsal hump housing the flight deck. The bump is a cavity backed slot dipole used to talk to other parts of the world via satellite. The antenna was first used on February 16, 1970, while a 747 was on a Seattle-Honolulu-San Francisco flight for Pan American World Airways.

Two NASA satellites — the ATS-1 in synchronous orbit over the Pacific and the ATS-3 over the Atlantic — were involved in the test transmission, which produced voice communications of outstanding quality. ❖

EA CROSSWORD

ACROSS

1. Second part of FIFO. (5,3)
5. Electronic organs have this in control. (6)
10. Said of system based on eight. (5)
11. Formative mode of certain printers. (3,6)
12. Computer socket. (4)
13. Tips of pickups. (5)
14. Particle. (4)
17. Part of an electric motor. (7)
19. Exploratory spacecraft. (6)
22. Characteristic of adjacent conductors, —— inductance. (6)
23. Connected in a particular way. (7)
26. Ancient instrument. (4)
27. Work table. (5)
28. Type of saxophone. (4)
32. Time limits (for paying phone bills?). (9)
33. Pertaining to law of resistance. (5)
34. Checks for electronic bugs. (6)
35. Worldwide information system. (8)

DOWN

1. Type of disk. (6)
2. Spinning member (5)
3. Stance angle of hardware, etc. (4)
4. Modernising. (8)
6. Common form of energy loss. (4)
7. Part of a player. (9)
8. Bring about greatest result. (8)
9. Home of Olivetti. (5)
15. Concepts resulting from mental activity. (5)
16. Transmission line systems. (5)
18. Connection between units. (9)
20. Collapses violently. (8)
21. Major brand of mobile phone. (8)
24. Sir James ——, (1877-1946), astronomer, and popular writer. (5)
25. Name given to Grumman F-14 airplane. (6)
29. Unit of light flux. (5)
30. Spot on radar screen. (4)

SOLUTION FOR AUGUST 1995

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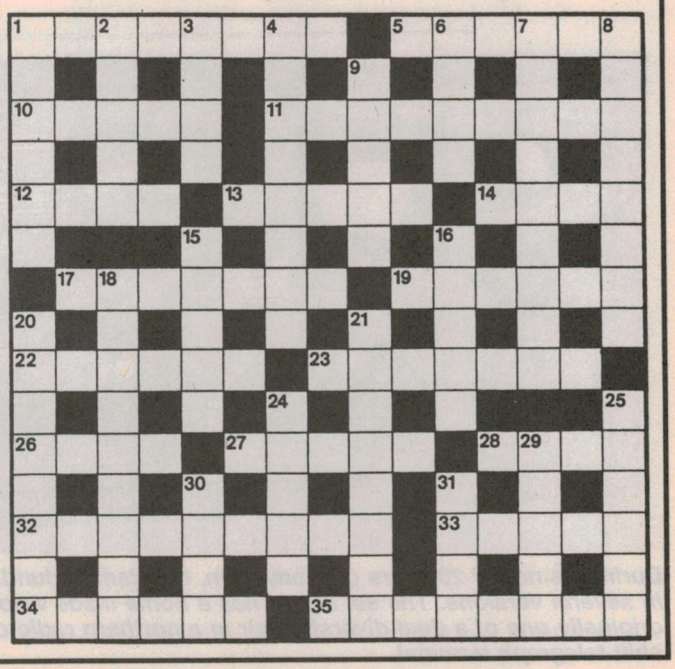
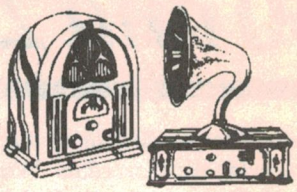


Vintage Radio

by PETER LANKSHEAR



The Hammarlund Super Pro Receivers

Last month we saw how, early in 1932, the Danish born Oscar Hammarlund's New York manufacturing company proved that not only was the shortwave superheterodyne communications receiver a practical proposition, but also it had a superior performance to the then-standard shortwave regenerative TRF receiver.

Domestic shortwave superhets were also appearing, and although they had some features in common with receivers intended for communications work, two quite different classes of equipment developed — and with few external resemblances. Whereas domestic radios were intended to look like furniture, communications receivers had metal front panels, more controls, and usually metal cabinets, were often without internal speakers and no attempt was made to disguise their technical appearance.

There were essential characteristics that defined the classic communications receiver. High quality domestic sets could meet some of these requirements, but by and large the specifications were too stringent for, or were absent from run of the mill receivers. Summarising, these were:

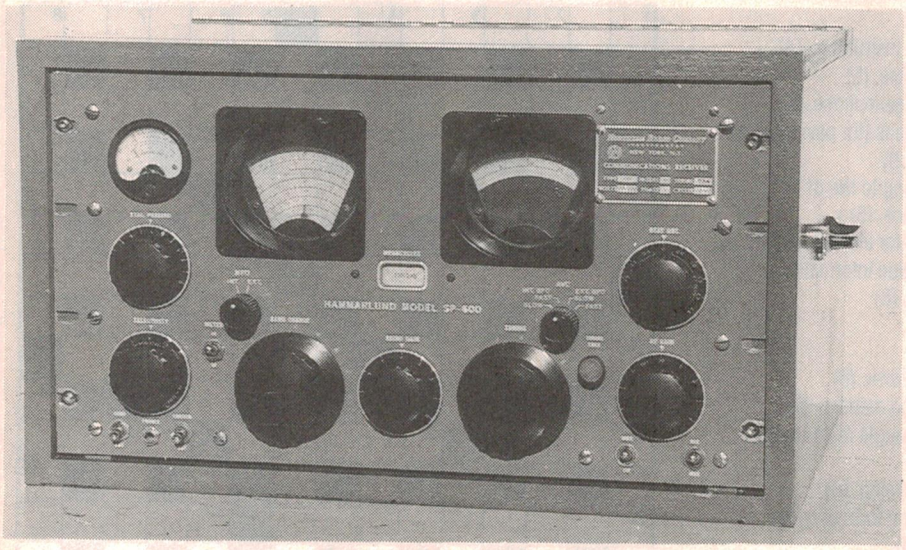
1. High sensitivity, with a good signal to noise ratio together with the ability to handle a wide range of signals without overloading.
2. Good selectivity, preferably variable, with high rejection of adjacent signals.
3. A minimum of images and spurious responses or self-generated signals.
4. Mechanically and electrically very stable. This demanded sturdy and solid construction.
5. Tuning systems had to have easily read dials and accurate resetability to a given frequency, coupled with low tuning ratios to provide accurate tuning of all kinds of signals.
6. An internal beat frequency oscillator was essential.

The Hammarlund 'Comet Pro', described last month, and generally considered to be the first true communications superhet, was able to meet these specifications, with one exception. Lack of an RF stage in front of the mixer created a problem with images. These, at twice the IF frequency, were nearly 1MHz removed from the fundamental, but strong signals could still break through at the higher frequencies. Initially this would not have been a major problem, but as the popularity of the shortwave bands increased, so too did the nuisance factor of images, which have the annoying habit of appearing right on top of a wanted signal.

There are two ways of reducing images in conventional superheterodynes. One is to raise the intermediate frequency; but in practice, for general coverage receivers, there is an upper limit of about 500kHz. (Receivers without broadcast band coverage sometimes had an IF of around 1600kHz, but selectivity then became a problem).

The other approach is to improve rejection before the frequency converter, by providing extra tuning for the incoming signal, usually in the form of one or more RF stages. As frequency converters tend to be very noisy, RF stages also have the important benefit of improving the signal to noise ratio.

Although band changing would become more complicated, the obvious way to improve the Comet would have been the addition of an RF stage.

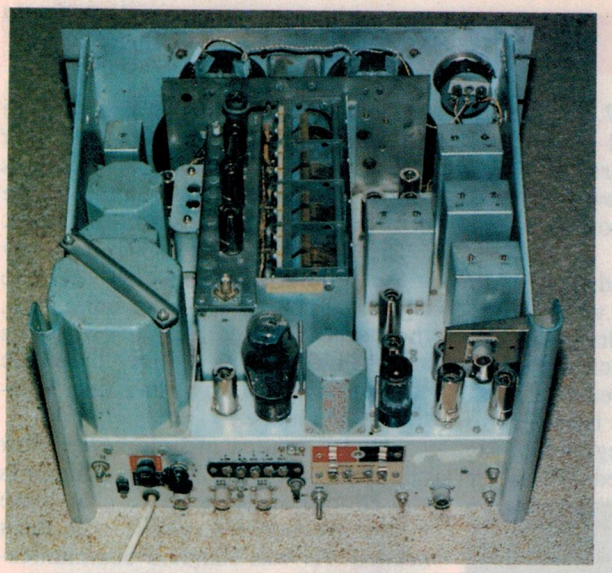


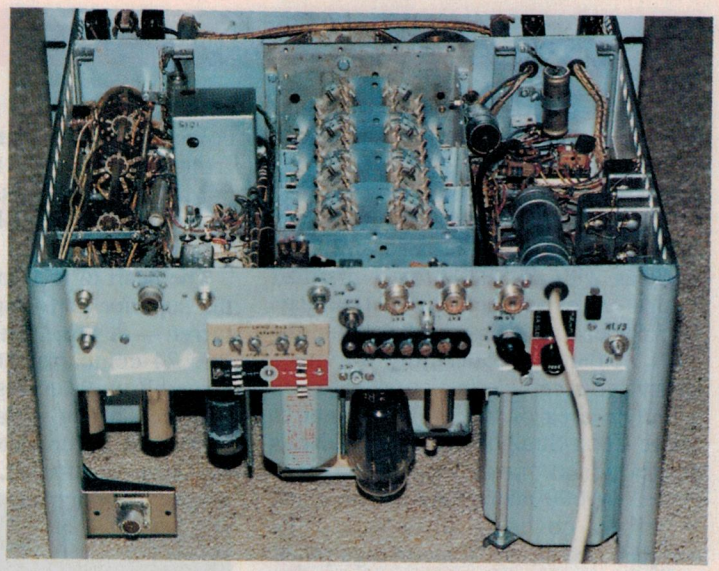
During its nearly 20 years of production, the Hammarlund SP600 was available in several versions. The set above has a home made wooden cabinet and was originally one of a dual diversity pair in a northern radio company's frequency shift telegraph terminal.

A new generation

Meanwhile, the competition had been busy, and by 1935 the new generation of communications receivers had appeared, led by the legendary National HRO fitted with an unprecedented *two* RF stages. Good as it had been, Hammarlund's Comet Pro was no match for these new models.

Of course, as any progressive manufacturer would have done, Hammarlund foresaw the eventual obsolescence of the Comet and had been developing an improved model. Mid-1935, they announced a new receiver to





Left: The rear view, with the tuning capacitor cover removed, revealing the four split stator and rotor sections. Note the massive cast case for the power transformer and chokes. Right: With the underside covers removed, the turret, heart of the tuning system can be seen to dominate the interior of the chassis. Note the silver plate contact pegs projecting from each module base. Between each group of pegs are the air spaced trimmer and slug adjusting screws. The wafer switch to the left is the variable selectivity control.

be called their 'Super Pro'; but it was March 1936 before the first examples were released.

Just as 18 months previously, the National HRO had revolutionised receiver performance, so the Super Pro in its turn set still higher standards. Its appearance and specification were impressive. Like the HRO, there were two RF stages, but the Super Pro, with five switched bands covering from 550kHz to 20MHz had a directly calibrated main dial and a second dial for the mechanical bandspread, together with precision geared drive. One considerable advance was efficient bandswitching.

The front panel was the standard width for rack mounting, as an alternative option to a metal cabinet, and the large, tightly packed chassis was practically square. Fig.1, reproduced from a 1936 advertisement in *QST*, shows some of the outstanding features.

Much of the success was due to the quality of the mechanical construction, and generally, the electrical design of the Super Pro was conservative and conventional. A unique feature was fitting the aerial coils with Faraday electrostatic shields, made from woven thread and wire, to reduce the transfer of man-made noise from the aerial.

Four IF stages

Although by 1936 metal valves were fashionable, all 16 valves in the Super Pro were, like those in National's HRO, the older and proven glass types. In the front end, two type 6D6 were used as RF amplifiers, and a 6A7 was paired with an electron-coupled 6C6 oscillator for frequency conversion. There followed an optional crystal filter and an unprecedented *four* 465kHz IF stages, with continuously variable selectivity, the spacing of the windings being adjusted by means of cams controllable from the front panel.

Four IF stages were not necessary to obtain sufficient amplification. The prime reason was to obtain an IF bandpass response with very steep sides, and by running each stage conservatively, this was achieved with considerable stability. The IF amplifier valves used were three 6D6's and a 6B7 diode- pentode, which served also as a diode detector. There was yet a further IF stage using a 6B7 as a separate AGC amplifier and rectifier. In all, the original Super Pro had no fewer than *seven* IF transformers! Another sharp cutoff 6C6 was used as an electron-coupled BFO.

High power audio

The audio amplifier had an element of overkill! A type 76 general purpose triode fed a triode-connected standard 42 output pentode.

This combination would have been adequate for most communications work. But Hammarlund obviously considered this to be unworthy of a premium receiver, and fitted an extra transformer coupled push-pull triode connected pair of class AB 42's, capable of a nominal 15 watts! This configuration, by the way, had been used a couple of years previously by Philco in some of their very popular cathedral and console receivers.

There was a separate cabinet for the power supply, with dimensions in keeping with the massive receiver. A 5Z3 was used for the HT rectifier, and a type 1V for the bias rectifier.

The Super Pro lived up to its promise of providing a superior performance. It was primarily a professional receiver, as the name implied. The price put it out of reach of all but the most affluent amateurs and shortwave enthusiasts. Major users were government and large commercial organisations, and military versions were soon being made.

Amateurs were not denied possession of Hammarlund receivers, however. In 1938 the HQ120 became available, a top performing model, but only half the price of a Super Pro and with calibrated amateur bandspread and reviving the HQ prefix.

By now, the SP100 had replaced the original Super Pro, but the only change was the substitution of half the valve complement with their octal-based metal equivalents.

The Super Pro 200 series followed. These were basically the original model, but with 18 octal valves and with a noise limiter as a new feature — but now with only three IF stages.

With the outbreak of World War II, there was a huge and initially unsatisfied demand for communications receivers, and in the USA large numbers were made, including the National HRO, the RCA AR-77 and AR-88 and of course, the Hammarlund SP200.

Hammarlund design and quality came to the fore during this period. It has been claimed that their 'APC' variable capacitors were at one stage being produced by 10 different manufacturers, at the rate of one million a month!

It was with an SP200 that I first had 'hands on' experience with a Hammarlund Super Pro. This was in 1950 at the New Zealand Broadcasting Service's shortwave receiving station, situated on a remote area of the hills 300 metres above Cook Straight and with a DXer's dream aerial 'farm' populated with numerous 600-metre long rhombic and V aerials, covering all points of the compass and all on 20 metre high poles.

There was a wide choice of top-line receivers, including Eddystone, STC, Canadian Marconi, HRO clones and RCA models. But when reception conditions were bad, a Hammarlund SP200 was unquestionably the best performer, and the universal favourite. It says much for Hammarlund engineering that this was in spite of the receiver being basically the 1936 design, with the RF stages using the already obsolete 6K7 valve.

At the conclusion of hostilities in 1946, Hammarlund were able to put into production the SP400. Basically, it was the proven old SP200, but with some minor valve changes.

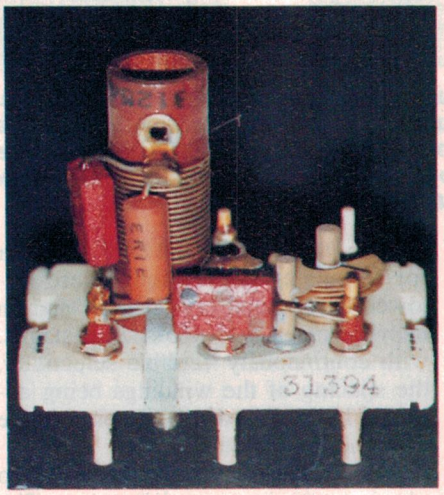
Meanwhile, however, significant developments were under way. A new Super Pro was taking shape. Using their experience of a decade of Super Pro production and wartime developments, Hammarlund's SP600 receiver was a completely new design, but it was not until 1952 that it was finally released.

An historic anomaly

It is here that one of those situations occurred that can mislead historians. Four years earlier, the 1948 *Radio Amateur's Handbook* had included a full-page Hammarlund advertisement with technical details and even a drawing of the SP600. The problem is that it bore little resemblance to the production model SP600.

The real SP600, with no fewer than 20 valves, was certainly worth waiting for. Oscar Hammarlund, who died in 1945, would have approved. It bristled with interesting features, and has been referred to by several writers as the finest conventional superheterodyne communications receiver ever made — capable of holding its own even with later specialist receivers, including the Wadley-Loop Racal RA17. Frequency coverage of the standard model was from 540kHz to a remarkably high 54MHz, in six bands. A low frequency version, the SP600-LF, covered from 15kHz to 540kHz.

The heart of the front end, and key to the superior performance, was the coil turret — a large rotary drum divided into 24 compartments, each for a coil assembly with its associated capacitors mounted on an isolantite base. These bases had silver plated pegs which, as the drum was turned, mated with silver plated spring contacts located between the tuning capacitor and the associated RF and oscillator valve sockets.



Individual coil modules are complete sub-assemblies and are readily unclipped from the turret. This is the oscillator coil unit for the 7.4 to 14.8MHz band.

There was therefore no wavechange switch, and lead lengths were sufficiently short for efficient 50MHz operation. The turret effectively combined the efficiency of the HRO coil boxes with the convenience of the wavechange switch. Some years later, Philips used a turret successfully for their TV tuners.

Ceramic shaft

The split-stator four gang tuning capacitor can be seen in Photo 2. What may not be obvious from the photo is that the brass vanes are gold plated and to minimise coupling between stages, the shaft is made not of metal, but Isolantite!

The manufacture of a component like this demands extreme precision and skill. Ceramics such as Steatite and Isolantite shrink considerably during firing, and cannot be turned to an exact size afterwards. Isolantite manufacture was a Hammarlund specialty and their standard insulation, and their receivers have little of the usual bakelite and fibre used extensively in conventional radios.

The SP600 circuit is significantly more complex than that of the earlier Super Pros. As an indication, the parts list specifies 129 resistors and 184 capacitors. Many domestic receivers would have had only one-tenth this number.

The RF stages are choke/resistor coupled, with the circuit constants chosen to provide increased gain at the higher frequencies, where it is most needed. As was standard communications receiver practice, the high frequency oscillator was a separate valve, and in the set illustrated, which was half of a pair for diversity reception, it is a double triode arranged so that, if required, an external master oscillator can be used.

Then follows the first mixer, a standard pentagrid 6BE6, the anode of which is connected to a double frequency IF transformer T1. Some models had the option for fixed frequency operation using V3 with up to six switched crystals.

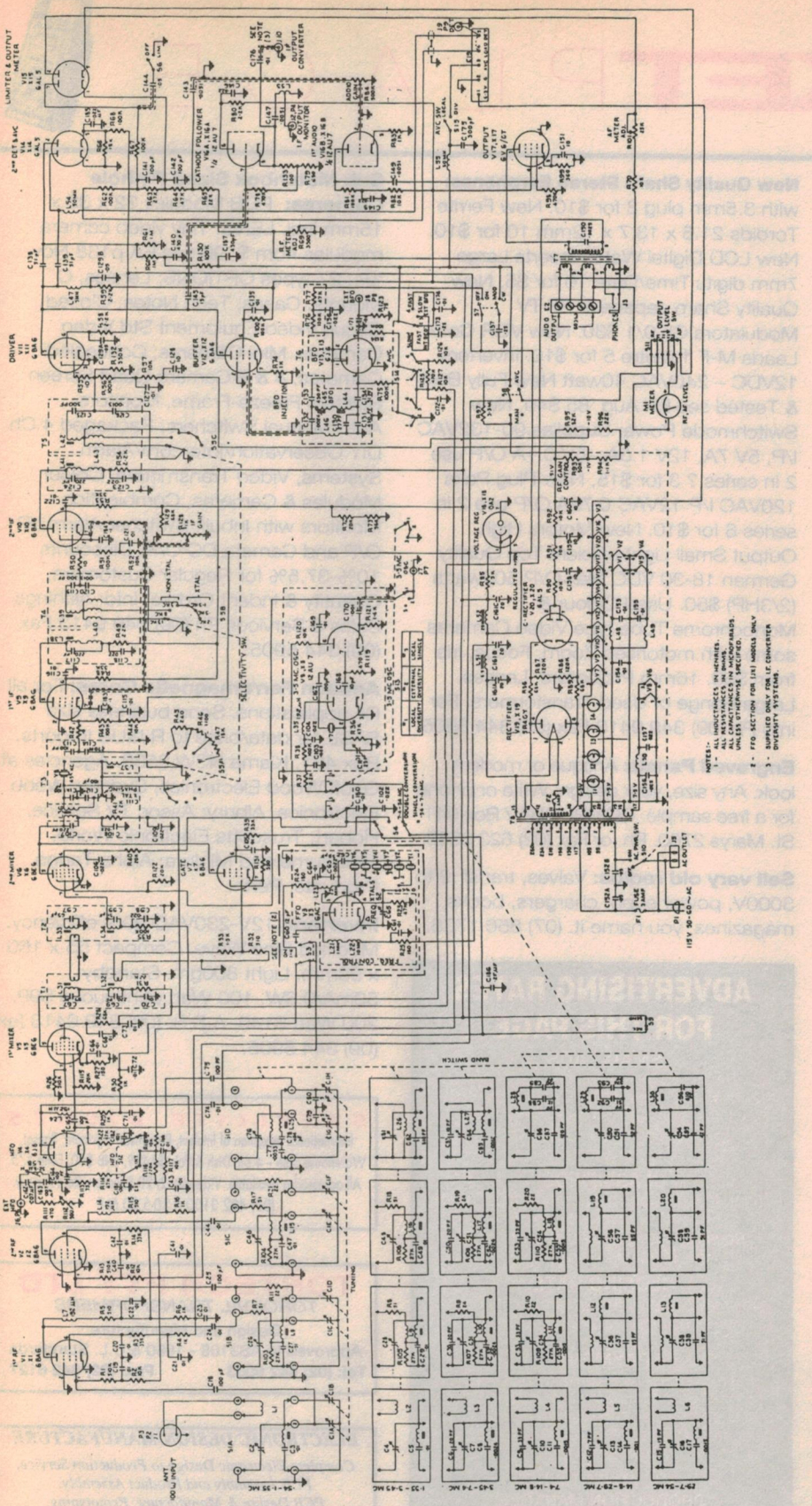
Double conversion

At the highest frequencies covered by the SP600, with the standard 455kHz IF necessary for good selectivity, and despite the use of two RF amplifiers, images would be a problem. The ingenious solution adopted by Hammarlund was to use double conversion for the top three bands.

These signals were first converted to an IF of 3955kHz before being coupled via T2 to the second mixer V6, another 6BE6. Here signals were mixed with the output of the 3.5MHz crystal oscillator V8 to produce the main IF signal of 455kHz.

Signals for the three lower bands left the first mixer already converted to 455kHz, and were automatically directed to a straight amplifier V7, called a 'gate', operating in parallel with the second mixer. All IF signals appeared at the anodes of the V6 and V7 to be passed on to the crystal filter and the IF system with six switched positions, rather than the continuously variable selectivity of the earlier models.

Valves 9, 10 and 11 comprised the traditional three-stage IF amplifier, providing considerable amplification and drive to the AGC and detector



The circuit of the SP600 is well worth tracing out as it reveals many innovations and unusual features. There were several variations of the receiver for specialist applications, this version being adapted for diversity reception using two receivers connected to widely spaced aerials and with inter-connected oscillators and AGC systems.

diodes V14. There was actually sufficient detector current for direct reading by the signal strength meter, calibrated in dB above one microvolt.

With several volts of audio from the detector, minimal amplification was needed from V16B before the signal passed on to the single 6V6GT audio output stage. In contrast with the earlier Super Pro powerhouse audio systems, the SP600 provided only a couple of watts at 600 ohms, primarily intended for feeding an audio line which can be monitored by the signal strength meter.

Associated with the detector are two unusual facilities. V16A is a cathode follower, providing an output of the IF signal for connection to external equipment. To ensure complete stability and eliminate any possibility of 'pulling', the BFO (V13) had a buffer amplifier, V12.

A high tension and a bias rectifier, together with a voltage regulator are needed for the power supply. The power and audio transformers and filter chokes are in keeping with the rest of the engineering of the SP600, being sealed in octagonal cast cases with ceramic terminals.

The SP600 is a handsome receiver, with the controls located in just the right places for prolonged periods of operation. Naturally, accuracy and resetability of dials was paramount. Each band had 6000 readable divisions with very precise drives and no backlash. As one old time 'sparkie' commented after a session with mine, "That is an operator's receiver!"

One development that caught up with

Continued on page 104

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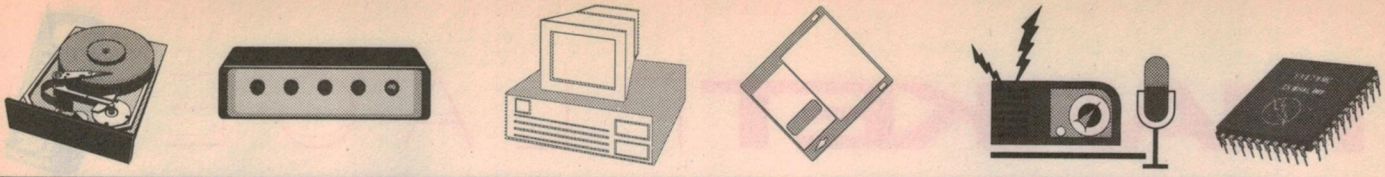

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VINTAGE RADIO

Continued from page 101

the SP600 after it went into production was the increase in single sideband traffic. While the stable and flexible BFO is ideal for CW and RTTY transmissions, there is insufficient injection and the diode detector is not suitable for single sideband operation. Hammarlund overcame this problem with the SPC-10 SSB converter, which can be driven from the SP600 IF cathode follower.

If space permitted, there are still more details of interest that could be mentioned; but I think that sufficient has already been written to show that the SP600 is quite a receiver. It is only recently that solid state technology has been able to match the performance of the great communications receivers of the valve era. The Super Pro 600 was specified to resolve a 1uV CW signal with a 10dB signal to noise ratio.

The major advance in modern receivers has probably been frequency synthesis, eliminating the huge dials and the need for the complexity and precision of the drive mechanisms of the classic receivers.

At one stage, the US military released a large number of SP600 receivers for sale to the public, and examples regularly appear in the American amateur and vintage radio magazines 'for sale' columns at reasonable prices, and to make a purchase is a practical proposition. There is one catch however — although the major metalwork is aluminium, the weight with cabinet is over 40 kilos. Hardly 'carry on board' luggage!

The SP600 was the last of the Super Pro line, and remained in production until at least 1970. For a receiver to remain in production for 18 years without major modification, it had to be an outstanding design.

Odd spot

By far the most frequently used valve of the 1920's was the 201A, and it was the subject of this column for April 1991. Nine years ago, the US-based Antique Wireless Association reported on a project initiated by renowned valve historian Bro. Patrick Dowd, identifying just how many different brands of 201A could be identified.

In their May 1995 Bulletin is an update, listing a staggering 513 brands, including Australia's AWA. No wonder the '01A is claimed to be the most popular and duplicated valve of all time! ❖

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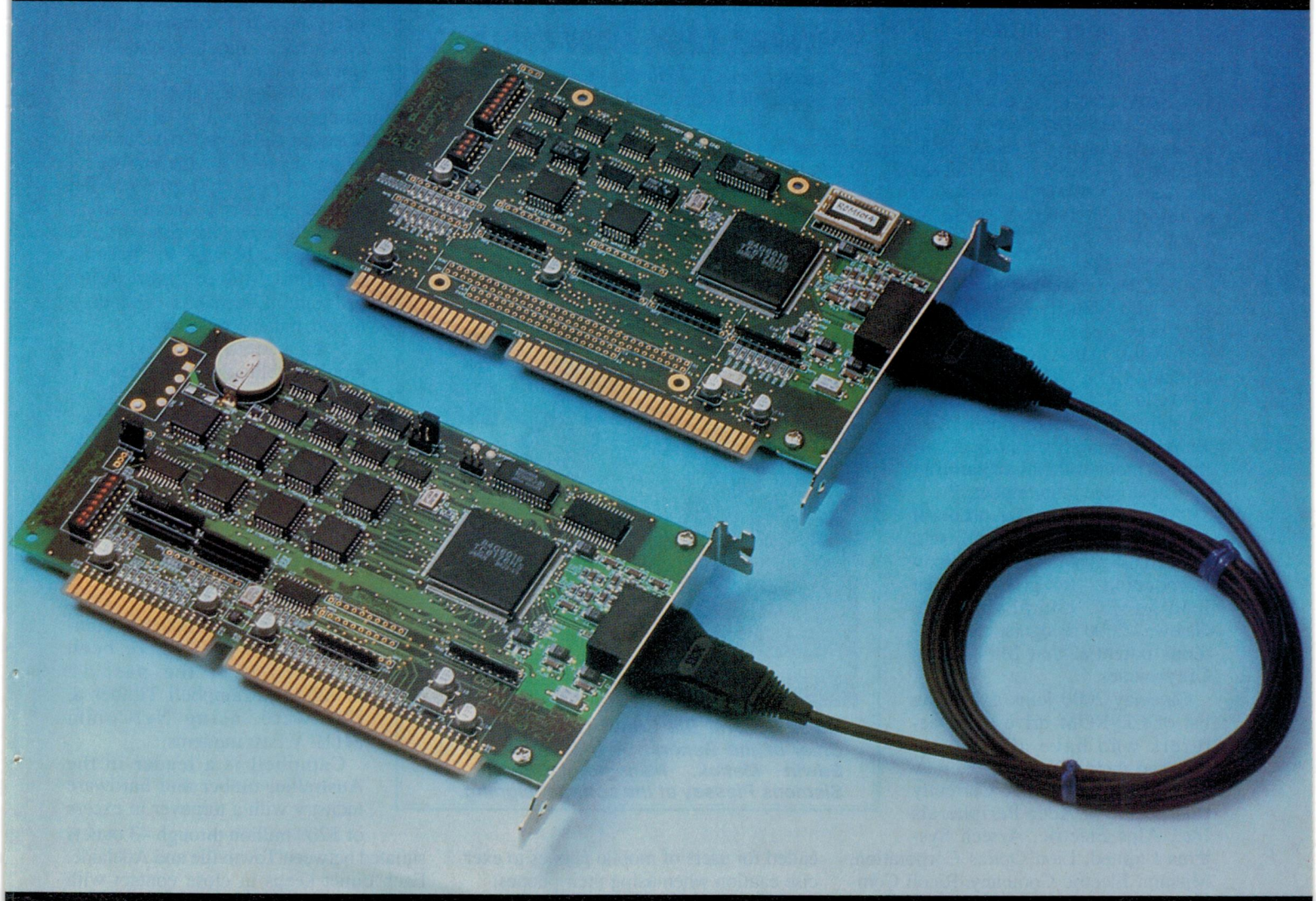

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NEWS HIGHLIGHTS

MORE SUPPORT FOR PHILIPS/SONY MMCD

Philips Electronics and Sony Corporation have announced that Gateway 2000, a leading provider of multimedia personal computers, has become the first PC manufacturer to endorse the new high density MultiMedia CD (MMCD) format.

The Philips/Sony MMCD calls for a single sided compact disc that provides up to 7.4GB of data capacity, while ensuring full backward compatibility with current CD-ROM discs. As one of the industry's largest providers of personal computers, Gateway 2000 expects this format to be adopted for a variety of applications such as research, interactive entertainment, business and finance, and on-line storage.

"We have carefully evaluated other high density disc formats that have been proposed," said Ted Waitt, Gateway 2000 President and CEO. "The Philips/Sony MMCD offers the type of reliability, affordability and backward compatibility that is essential to meet today's expanding optical storage requirements."

"With each day, our proposal continues to gain support," said Dr Teruaki Aoki, Director, Sony Corporation. "It's gratifying that leading PC companies like Gateway 2000 recognise the enormous potential that MultiMedia CD provides."

Gateway 2000 joins a growing list of CD-ROM drive manufacturers who have already announced their support of the new MultiMedia CD format. Currently this includes Acer Peripherals Inc., Alps Electric, Aztech Systems Limited, Lion Optics Corporation, Mitsumi Electric Company, Ricoh Company, TEAC Corporation, and Wearnes Peripherals. In conjunction with Philips and Sony, these manufacturers represent approximately 70% of the CD-ROM drive industry.

Aiwa, Bang and Olufson, Grundig, Magnavox and Marantz have previously announced that they will manufacture products for consumers based on the MultiMedia CD format. Along with Philips and Sony, these companies are manufacturing and marketing over 50% of the current CD players world wide.

CAUTION ON MOBILE PHONE USE

A prominent safety professional has called for users of mobile phones to exercise caution when using their phones.

"Whilst there is no proof of any harmful health effects from the electromagnetic radiation transmitted by mobile phones, the phones should be used prudently," said Chief Executive of the National Safety Council of Australia and medical physicist, Jim Whiting.

"As with all potential risks, we can minimise exposure to the risk, without overreacting. There are three simple ways of reducing the risk of exposure to any form of radiation. We can increase the distance between ourselves and the source, reduce the length of time of exposure, and place a barrier or shield."

"Always use mobile car phones hand free, so the antenna is not close to body parts. This also works as a shielding factor, and is required for driver safety anyway. For the time factor, don't have unnecessarily long conversations."

Mr Whiting said that the acceptance of any risk is always influenced by the benefits, as well as the certainty of the known effects. "For mobile phones, the latest research from North America shows the risks are uncertain; but because the benefits are great, the common value judgement supports their continued, but controlled, use."

"As a medical physicist, I won't be telling my family to stop using their mobile phones. But I will be telling them how to reduce their exposure to any such risk, however improbable. When in doubt, you should manage the risk, don't avoid it completely."

SPES WINS $30M ARMY CONTRACT

Siemens Plessey Electronic Systems (SPES) has signed a $30M contract with the Australian Army for the supply and installation of VHF Receiver/Transmitters, installation kits and ancillaries under the Project Raven — Vehicle Communications Equipment contract.

The equipment will allow the Australian Army to fully equip all existing armoured vehicles and other vehicles, as well as Command and Control and Headquarters elements with the Siemens Plessey RAVEN Combat Net Radio System.

Major General Bill Crews (Left), Assistant Chief of the General Staff Materiel and Mr Edwin Matiuk, Managing Director of Siemens Plessey at the contract signing.

FAST MODEMS CUT TELECOMM BILLS

Savings of up to 500% in communication costs have been achieved over the past 12 months by Campbell Timber & Hardware, using NetComm M11F V.Fast modems.

Campbell is a leader in the Australian timber and hardware industry with a turnover in excess of $200 million through 43 outlets situated between Townville and Adelaide. Each outlet keeps in close contact with head office via a fast and efficient communications system.

Prior to installing NetComm M11F modems, Campbells transmitted data between the head office and branch offices at 9600b/s. Now, with the NetComm V.Fast modems, Campbells can achieve

reliable communication speeds of up to 28,000b/s.

"We now spend less time on the line and so have dramatically reduced telecommunication costs. Our bill has dropped by $1,400,000 from $1/2 million to $100,000," said John Leahy, MIS manager at Campbells.

$40M CHINA CONTRACT FOR SIEMENS, MM CABLES

MM Cables Communications Products, a division of Metal Manufactures Limited, has been awarded a $40 million contract to supply optical fibre cable and SDH equipment for the development of communication infrastructure in China's Xinjiang province.

The contract is the largest export order that MM Cables has won. It involves the supply of more than 3000km of underground cable, forming the backbone of the Xinjiang's north-south telephone network.

The cable, which can carry about 10,000 voice calls per pair of fibre, or their equivalent, simultaneously, will be buried at a depth of 1.2 metres. The network will connect all the major population centres of Xinjiang, one of the largest and most remote of China's provinces.

The transmission equipment for the link, understood to be the longest SDH optical fibre link in the world, will be supplied by Siemens Ltd from its new Regional Centre of Synchronous Digital Hierarchy at Bayswater, Victoria.

PHILIPS WINS OPTUS PAY-TV CONTRACT

Optus Vision, one of the major players licensed to deliver Pay TV to Australian homes, has chosen BTS, the Philips Broadcast Television Systems business unit, as its primary supplier of advanced digital studio equipment, automation systems and presentation equipment, for its main program service centre.

The Optus Vision contract comes only three months after BTS won the contract to equip the ABC's Pay TV subsidiary Australian Information Media's studio complex. It's the largest contract secured by BTS in Australia, and is believed to be the largest single order won by any Australian studio and production equipment supplier.

Optus Vision is constructing its Pay TV centre at North Ryde, on the site formerly occupied by Channel Ten.

At the core of the project is a Philips BTS Venus digital routing system, said to be the biggest routing system in the southern hemisphere and among the largest installed anywhere in the world. This device operates as the backbone of the installation and takes care of all signal distribution, video and audio, throughout the complex, meeting both current and future demands. To control the router, a Philips BTS Jupiter control system will take care of all administrative and supervisory functions within the routing system. With many thousands of switching cross points to look after, this task is only reliably achievable if administration is taken care of by a computer based system.

Philips BTS cameras, LDK 93, have been selected for transmission from the newsroom studio and a Diamond digital DD 30 production switcher will be the main production switching unit.

Master control switching is taken care of by Philips BTS Saturn presentation switchers, all digitally interfaced, and controlled by Alamar automation to ensure reliable integration and control.

Wandel & Goltermann has added two handheld analysers to its range of radiation meters. The new meters are suitable for checking work place safety, and also for electromagnetic compatibility testing. They measure fields in the range from 10nT to 10mT.

TEN USING FIRST DIGITAL SAT LINK

The Ten Network has chosen the advanced PowerVu compression system, manufactured by Scientific Atlanta, for the first end-to-end digital satellite link to be established by a major Australian broadcaster. The link provides Ten with the facility to distribute six channels of digital programming from the West Coast of America to Australia. However, the Ten Network will only use one of the channels and sub-lease the others to recoup its satellite costs.

The ABC will take up three of the digital PowerVu channels. Two will be used by ABC TV and the third for its Pay TV subsidiary, Australian Information Media. The ABC has also specified four audio channels and one data channel in addition to the video channels.

The two remaining channels on the satellite link will be leased to other customers, according to Mr Peter Booth, Manager of satellite planning at Network Ten.

Mr Doug Cohen, sales manager of Scientific Atlanta Network Systems Group, said: "We are proud to be working with Ten on this project and pleased that after extensive evaluation of picture quality from major Australian broadcasters the PowerVu system was chosen."

He said network Ten has purchased 24 professional PowerVu decoders to be located at a number of downlink sites: at the TEN-10 studios in Ultimo, Sydney, at ABC Television in Gore Hill, Sydney, at the Telstra international earthstation at Oxford Falls and at TV3 in New Zealand.

Telstra has been contracted to downlink the signal for Ten, but the broadcaster will be keeping the signal in digital format for the microwave link to Ultimo, where decoding will take place.

NEWS HIGHLIGHTS

MANAGEMENT BUY-OUT AT VICOM

Directors of Australian telecommunications company Vicom Australia have announced that the 100% equity of the company held by Mr Russell Kelly has been sold to a management buy-out for a non-disclosed amount.

The new owners, Mr Greg Kelson and Mr Bruce Williams, have been senior managers with the Melbourne based company for a number of years.

Vicom is a significant Australasian supplier of test and measurement, defence and communications systems and was established in 1974 by Russell Kelly who built the privately held company to its present status.

New managing director Greg Kelson said that he was excited about the myriad opportunities presented by new technologies and deregulation of the telecommunications markets.

Vicom recently won a significant defence order with Telecom for the supply of oblique incidence sounders, an important component of the Jindalee Over the Horizon Radar (JORN) soon to protect Australia's north.

KEY TECHNOLOGY FOR SUPERHIGHWAY

The International Telecommunications Satellite Organisation (INTELSAT) has announced the development of a key component in the telecommunication industry's quest for high quality, high data rate broadband services delivered via satellite. Over the coming year, INTELSAT will be testing this component, an advanced FEC encoder/decoder ('codec') designed specifically for use with the Organisation's current fleet of international telecommunications satellites.

The new device will be able to deliver such services as up to 10 high definition TV channels — or up to 50 regular, broadcast quality TV channels — bundled for simultaneous transmission over a single INTELSAT transponder. Used with 8PSK modulation, the FEC codec can also be used for efficient restoration of 155Mb/s fibre optic cable links. Additionally it is likely to put to use accommodating Asynchronous Transfer Mode (ATM) transmissions, supporting the burgeoning demand for high speed communications.

The development of the codec was required in order to transmit high quality high data rate applications such as the Broadband Integrated Services Digital Network (B-ISDN) at the basic STM-1 rate of 155Mb/s over standard 72MHz satellite transponders. The development effort was carried out by the Institute for Telecommunications Research in Adelaide, South Australia, and entailed the concatenation of two codecs. An 'inner' codec and an 'outer' codec were effectively combined to yield an overall signalling rate of 62.22 million symbol/s, fully compatible with 72MHz transponder channels such as those carried on INTELSAT's spacecraft.

In operation, the new codec delivers an information rate of 155.52Mb/s which, at an Eb/No of 10.8dB, is delivered at a BER (bit error rate) of 10^{-10} over a 72MHz satellite transponder.

It is currently being integrated within a production series 8PSK modem by EF Data Corporation in Phoenix, Arizona.

The integrated modem/codec will shortly undergo rigorous testing in pilot operation both at INTELSAT's Technical Laboratories and over INTELSAT satellites. Initially, loop back tests are planned in Australia, followed by trans-pacific trials between Australia and the United States and trans-Atlantic testing between Canada and Europe. These trials will be conducted on C-band (6/4GHz,) using existing INTELSAT Standard A earth stations.

Ku-band (14/11 and 14/12GHz) and ATM transmission tests are slated for the future to more fully explore the potential of this advanced technology.

GFS Electronics in Mitcham, Victoria, is now distributing the Clarke range of pneumatic telescopic masts with extended heights to 40 metres.

NEWS BRIEFS

- ***Racal Australia*** has been appointed Australian distributor for US-based Interface Technology, a manufacturer of digital test instruments and related products.
- As a result of ongoing growth and expansion, wirewound component and inverter manufacturer Selectronic Components of Melbourne has been renamed ***Selectronic Australia. Company ownership, personnel, phone and fax numbers are unchanged.***
- ***St Lucia Electronics*** has been appointed a regional distributor by Tektronix for their range of Tek Tool and Tek Bench instruments, probes and accessories.
- From October 3 to 11 the International Telecommunication Union will host ***TELECOM 95*** in Geneva. For further information phone +41 22 730 6601.
- NJS Technology has announced that ***HarTec*** has purchased a 50% equity in the company. HarTec is a distributor of semiconductors to the manufacturing industry.
- ***Panduit Australia*** has appointed a specialised sales team to focus on their range of network wiring products, PAN-NET.

SHANGHAI SELECTS TOSHIBA FOR CATV

Toshiba Corporation's cable television home terminal systems have been selected by Shanghai Cable Television, China's largest cable television (CATV) operator, for upgrading CATV services offered to subscribers in Shanghai.

An agreement has been made among Toshiba, Shanghai Cable Television Industrial Company, a solely owned subsidiary of Shanghai Cable Television, and two other parties, Shanghai Jinling Co, and Sunny Ocean Communication (H.K.) Ltd, to establish a joint venture in Shanghai to manufacture and market CATV equipment. Toshiba will provide its manufacturing technologies for CATV equipment to the joint venture.

The joint venture will start manufacturing PAL format CATV home terminals (set-top boxes) for the Chinese market later this year in Shanghai Jinling's current facilities in Putong, the high technology development area of Shanghai. Annual production capacity will be about 500,000. The company is also expected to produce CATV related products for exports.

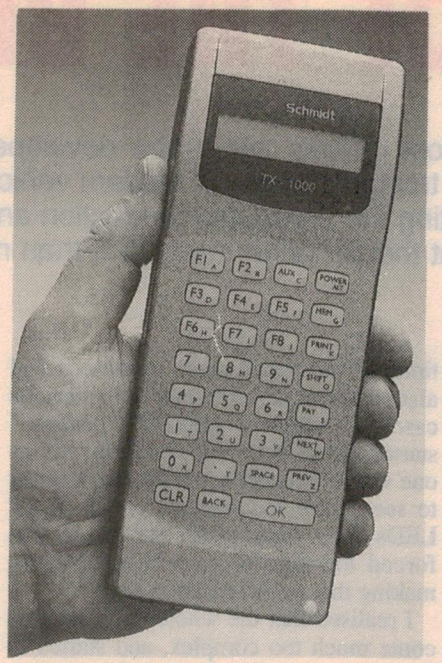
Shanghai already has an advanced optical fibre cable infrastructure, which currently provides CATV services to 1.2

VIC FIRM DEVELOPS SMART CARD TERMINAL

A Victorian company has developed a handheld, portable smart card terminal which has been designed for use with the stored value smart cards soon to be distributed by Australian banks. The full featured battery powered terminal, developed by Schmidt Electronic Laboratories of St. Kilda, is believed to be a world first for Australian technology. It is currently being tested in Victoria and New South Wales.

The terminal, called the TX-1000, enables a merchant or service provider to deduct value from a customer's stored value card. The terminal will store all transactions securely and at the end of a day's trading the merchant can connect the terminal directly to a phone line. The stored transactions are thereby transferred to a bank's computer where they will be credited to the merchant's account. The terminal can also read credit cards and charge cards.

The company's managing director, Gary Schmidt, said that the terminal has been designed for use with the world's emerging stored value card systems and the TX-1000 will fill an important market niche.



"Our terminals will make it possible for millions of merchants and service providers around the world who don't have ready access to mains electricity, to complete stored value card transactions for their customers. Examples include pizza and other fast food delivery services, market stall operators, roadside vendors, taxi and courier services, ice cream trucks, door to door salespeople, lawn mowing, gardening and window washing services, and the like, said Mr. Schemidt.

The terminal, which incorporates a built-in calculator, will also be very useful to retailers who transact large numbers of small value transactions such as milk bars, newsagents, fruiters, greeting card shops, coffee lounges and sandwich bars.

For many such retailers a portable terminal will be extremely convenient. In a coffee lounge or restaurant the server can bring the terminal to the table and complete the transaction in front of the customer, thereby eliminating the need for the customer to take the card to the cash register.

million households, one of the largest networks in the world. Shanghai Cable Television plans to upgrade its service by introducing pay channels.

BOCA RESEARCH ACQUIRES HAYES

Hayes Microcomputer Products, Inc, and Boca Research, Inc. have signed a letter of intent which will result in the acquisition of Hayes by Boca. Further, this transaction will result in the financing for Hayes to complete its Plan of Reorganisation to pay all creditor claims at 100% with interest. The resulting company will be named Hayes, to optimise the name brand recongition world wide.

When the transaction is completed, Dennis C. Hayes, Chairman and President of Hayes Microcomputer Products, will be the combined company's largest shareholder, a Director on the Board and will servce as Vice Chairman with responsibility for Strategic Planning, Corporate Communications, and Intellectual Property Management. Tony Zalenski, Boca Research's President and CEO, will be President and CEO of the new company.

Boca Research founded in 1985 and headquartered in Boca Raton, Florida, designs, manufactures, markets and supports quality, cost effective data communications, multi-media and networking products to facilitate the transmission of information on personal computers and computer networks.

EXPORT SUCCESS FOR AUST ANTENNAS

Overseas sales of high frequency (HF) antennas, designed in collaboration with the Defence Science and Technology Organisation (DSTO) are earning export dollars for Tasmanian manufacturer Moonraker Australia.

The collaboration stemmed from the problems experienced by the Royal Australian Navy with imported antennas, due to the extreme environment in which they operate. The combined effects of water, salt and electrical arcing rapidly degraded the antennas' performance, causing transmitters to overload.

Moonraker Australia specialises in the manufacture of small antennas for fishing and pleasure craft and teamed with DSTO and the Navy to design, develop and manufacture an improved high frequency antenna. A DSTO team led by scientist Gunars Bajinskis identified improvements that could be made to the existing antennas and developed a facility to test prototypes produced by Moonraker based on design concepts developed by Moonraker and evaluated by DSTO.

The end result was an Australian antenna, manufactured in two sizes — seven metres (23 feet) and 10.7 metres (35 feet) — which is the Navy's preferred replacement antenna and is used in all initial fittings.

STANILITE WINS $34M CELLULAR CONTRACT

Australia's Stanilite Electronics has signed a contract for a major cellular telephone infrastructure project in Argentina valued at $34 million.

The Argentinian cellular operator Compani de Telefonos del Interior S.A. (CTI) has contracted Stanilite to design, manufacture and supply on a full turnkey basis (deliver, install, integrate and commission) a system to cover over 400 sites in the interior of Argentina — one of the largest projects of this type ever undertaken in the world. Stanilite has previously supplied $20 million of products and services to CTI.

Under strict time limits imposed by CTI's license, Stanilite will be supplying and installing 34 Mobile Switching Centres, 297 Smart Cellswitch Remote Base Stations (SRBS) and the upgrade of 92 existing Cellswitches.

The system will provide full automatic roaming, connection to the PSTN and a range of advanced call features, and will be interconnected using satellite transmission technology. ❖

VOYAGE OF THE BEAGLE

The Beagle is a compact, low cost polarity test probe developed by Queensland inventor Dick Woodcraft, and designed for safe troubleshooting in modern vehicles. However while the electronic design is simple and elegant, getting the probe into production and on the market was quite an involved process — and shows that there's rather more to it than most people realise. The inventor explains...

It all started when I got tired of moving the test lamp clip from the frame (negative) to active (positive), when searching out circuits and tracking down problems in my car. I decided to build a *better* polarity indicator probe, that didn't need this sort of fiddling around.

The first model was quite simple, using a Tandy tricolour LED for the red/green indicator. This was quite OK in low light levels, where I couldn't see what I was doing. But it was not very successful when there *was* enough light to work comfortably, and it was almost useless in a good bright light.

I improved the visibility by using separate red and green LEDs, but it was still not really successful (this was about 10 years before high intensity LEDs became available). The next upgrade was to make the LEDs flash for greater visibility, using a 555 timer IC. By now the probe was becoming bigger, and I was still not happy with the visibility problem.

One day I noticed a Matchbox toy ambulance with opening rear doors, on a store shelf. I promptly bought it, and fitted two pairs of flashing LEDs — one pair on top, and the other pair inside. In bright light, opening the rear doors made the inside pair readily visible!

Until this time, I had been making them as a hobby, for my own use only. It occurred to me that there might be a market for them, so I approached a patent attorney and started the patenting process.

I found some 80mcd LEDs about that time, so purchased some of these. I had also been experimenting with various cases, in which to make the probes. I started using the brighter LEDs, and as one would expect they were much easier to see. I also found that I could set the LEDs about 3mm inside the casing; this forced the user to view them on-axis, making them even easier to see.

I realised that the whole thing had become much too complex, and started to see what could be dumped. As you can see from the final model, most of it not only could be dumped, but was dumped. Also about that time I came across a source of 'hi-lighter' pens, at a quite reasonable price.

With the innards removed, these became the cases. I had also found out about heatshrink tubing, and put this to good use as well.

Several people had commented favourably, so I decided to get some expert advice. To that end I approached an engineer at the Royal Automobile Club of Queensland. He told me that they have an absolutely inflexible rule never to pass judgement — good or bad — on anything at all.

He did however mention that normal test lamps are quite capable of burning out any automotive computer. Apparently the RACQ forbids its service mechanics to use the old style test lamps, because of the damage they can cause.

After the RACQ engineer's comments, I cut the current consumption down even further. I then phoned Bosch and spoke with one of their senior engineers. He told me that Bosch would not even tell *them* what current could be safely used on cars fitted with their computers.

He asked me how much current the probe tip draws, which I told him (a few milliamps). He then said that he would be quite happy to use one on his own car.

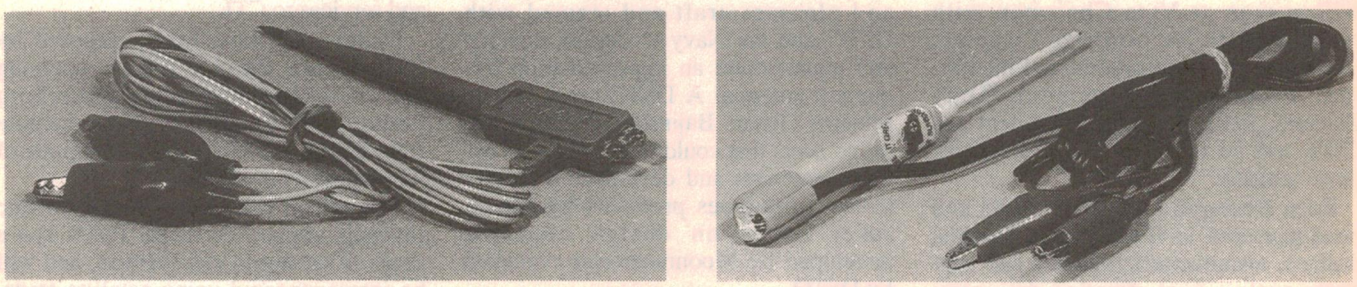
I am now using 250mcd LEDs. I can get much higher output red LEDs, but cannot find green LEDs to match. I found quite a bit of user resistance to the LEDs being set inside the casing, but with the high intensity LEDs that has become unnecessary.

Two other variations occurred, both for the same reason. If one or both of the power clips fall off, then one can waste time searching with the probe disabled. This could be quite a problem when one is working under the dash, or in some other uncomfortable position.

One solution was to have both LEDs lighted all the time, with one or the other extinguishing on probing either a 'live' wire or a wire at earth potential. But I found this a bit confusing — did the green going out mean I had probed an earth, or did the red staying on mean I had probed an active wire? Several people I tried it on didn't like this setup any better than I did.

The other solution was to get the smallest diodes I could, and build up a bridge. I then fitted a 3mm amber LED between the read and the green, via the bridge, to stay on all the time the clips were connected. I liked the idea, however it more than doubled the component count and was a beast of a thing to make and fit.

When I finally sorted out all the electronic problems and got the probe



At left is the latest version of the Beagle probe with two high intensity LEDs in a moulded case. On the right is an earlier version, using a modified marking pen case and a probe tip insulated with heatshrink sleeving.

design, I thought my troubles were at an end. How wrong I was...

I had to protect it, and that meant having it patented. I had to find someone to manufacture it. I had to find someone to market it. And I had to find and register a name.

My first attempt was 'Wirefinda'. That seemed to sum up its purpose, and was also easy to remember. But once again I was so wrong, it wasn't funny.

It's not possible to register a name which is descriptive of the use of the article. That effectively ruled out not only 'Wirefinda', but almost all of the other names I had been considering.

Someone suggested 'Circuit Detective', but obviously that also is descriptive. Fortunately the 'detective' part of the suggestion gave me an idea. I turned up *detective* in my thesaurus, and found several nicknames including Dick, Grabber, Frisker, Gumshoe, Sleuth — and also Beagle.

The more I thought about it, the more I liked it. A detective searching for a solution to a problem hunts out clues. Well, do does this device. Usually a detective is only needed when there is trouble, or at least *some* trouble. That also applies to this device. A beagle is a hunting hound, and hunts for quarry for its master. The probe is similar, hunting among wires and terminals — but instead of pointing or standing to attention, or whatever it is that hunting hounds do, the probe simply lights one of its two LEDs...

So that's the story of how the Beagle polarity probe came into existence, and acquired its name.

The Beagle was awarded first place in the monthly 'Invention of the Month' competition held by the Inventors Association of Australia, and also gained second place in the Inventor of the Year award, against 41 other entries. During the same competition a 'Viewers Choice' poll was conducted, and the Beagle gained first place with over one quarter of the total votes.

The managing director of an Australian organisation with branches in every state has told me that Beagles do not pop air bags. He should know, as they have been using Beagles for well over a year.

This particular firm specialises in installing top quality automotive ant-theft equipment. To back his judgement he has already purchased quite a few Beagles, and is putting them into their workshops throughout Australia.

The Beagle Polarity Testing Probe is being marketed by Zylux Australia, of 72 Station Street, Fairfield, Vic 3078; phone (03) 482 2203. ❖

NEW PRODUCTS

VF Displays

The Century Series is a new line of low cost, segmented vacuum fluorescent displays. Each module displays standard 64-character ASCII upper case alphanumerics with light emitting readability, and uses a 14-segment 'star burst' font.

They offer a unique jumper-selected multiple processor interface requiring no external circuitry, and all displays interface to Intel or Motorola host processors.

Two data interfaces are available: 8-bit parallel and EIA-232C serial at baud rates up to 19.2kb/s. Standard in all models are hardware and software reset features, an extensive self test routine and a very low power 5V DC operation with a -20 to 70°C operating temperature range.

Software controls include vertical and horizontal scroll modes, multiple level dimming control, multiple blink rates/fields, and a selectable 'screen saver' dimming or full display blanking features for increased tube life in 'constant on' applications.

Six models cover application needs from arms length instrument use to jumbo annunciators. The low profile, 100% surface mount technology gives a compact package.

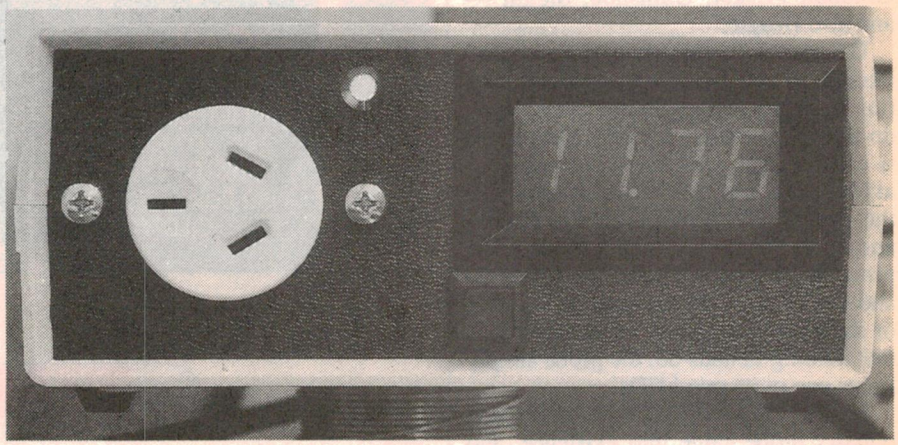
For further information circle 244 on the reader service coupon or contact M.B. & K.J. Davidson, 17 Roberna Street, Moorabbin 3189; phone (03) 555 7277.

Current interface for scopes

Sydney-based technician Phil Allison has developed a fully isolated current interface for equipment fault diagnosis. Designated the CM100, the device is also a fully isolated 3.5-digit ammeter with a measuring range from 1mA to 100A, from DC to 100kHz.

An Australian three-pin mains socket is fitted to the front panel for convenient workbench use without needing to access the mains wiring, as with a clamp meter. The ammeter is also true RMS, so it can be used with triac controlled circuitry. The 1mA resolution of the meter makes it suitable to check and adjust the bias setting of a transistor or valve amplifier.

For further information contact Phil Allison on (02) 799 8242.



Speech processor boosts SSB signals

According to Communications Equipment Company (CEC), the model SP-500 speech processor has been designed to help achieve maximum performance from SSB radio equipment. CEC claims the processors can provide an 8dB increase in a signal's readability under weak and noisy receive conditions. This increase in performance is claimed to have the same effect as more than quadrupling the transmitter output power.

The unprocessed human voice is not particularly suited to use with single side band (SSB) or amplitude modulated (AM) radio communication systems, which are inherently peak power limited.

A human voice is composed of a few high level amplitude peaks accompanied by a lot of average to low amplitude energy. Unfortunately the average to low amplitude component contains most of the voice's intelligence.

By increasing the amplitude of these components up close to that of the peaks, the SP-500 forces the radio to put a much higher level of power where it is needed most. Because the processing technique operates at RF (not audio), using its own internally generated SSB signal, the SP-5000 is said to produce a much cleaner output waveform and more 'talk' power at lower distortion than any audio-only processor or power amplified microphone.

The SP-500 is also a multi-mode end transmission beep (etb) generator. This function generates a brief tone when the radio's push-to-talk button is released, saving the tedious use of the word 'over' every time an operator has finished speaking.

For further information circle 242 on the reader service coupon or contact GFS Electronics, PO Box 97, Mitcham 3132; phone (03) 873 3777.

High speed pattern generator

Hewlett-Packard has announced a new 200 million vector per second pattern generator card for its HP 16500B logic analysis system. The new card offers faster clock speed, deeper memory and more output channels than its predecessor, at the same price per output channel.

The HP 16522A replaces the HP 16520A and 16521A, which were introduced in 1987. The HP 16522A has, compared to the 16520A, a clock speed that is four times faster (200MHz), an increase in memory depth from 4000 vectors to 258,000 vectors, and triple the number of output channels, from 12 to 40.

The card, which acts as a substitute for missing boards, integrated circuits or buses, lets software engineers create infrequently encountered test conditions and verify that code works, before complete software and hardware are available.

Other features of the new pattern generator include an assortment of clock and data pods that support TTL, CMOS, 3.3 volt and ECL logic levels; tri-state control for TTL, CMOS and 3.3 volt outputs; terminated and unterminated ECL outputs; and vectors referenced to an output clock with a variable-delay clock, which allows users to strobe data accurately at rates of up to 200MHz.

Up to five HP 16522A pattern generator cards can be installed in one HP 16500B logic analysis mainframe. In the 200 million vector per second mode, each card has 20 output channels. In the 100 million vector per second mode, each card provides 40 output channels.

The RRP of the HP 16522A is $10,000.

For further information contact the HP Customer Information Centre on 131347.

NEW PRODUCTS

Automated EMI test system

Dynamic Sciences has released a system designed to automate commercial and miltary EMI radiated and conducted emissions testing.

The system consists of an Rx-200 receiver, a 486 desktop computer with high speed data acquisition, a spectral display module, HPIB interface and a proprietary EMIT software package. The software combines the sensitivity and accuracy of a receiver with the speed and display capabilities of a spectrum analyser.

The Windows based EMIT software incorporates both pre-compliance testing and full compliance commercial EMC testing. Pre-programmed test plans are provided for FCC/ANSI, EN/CISPR and MIL/STD tests. The user can also create or tailor tests to other specifications.

The system provides an automatic calibration feature with ancillary equipment with lab set-up and management aided by the ability of the system to store data such as workstation identification, calibration files, EUT and customer identification, sensor corrections and site equipment.

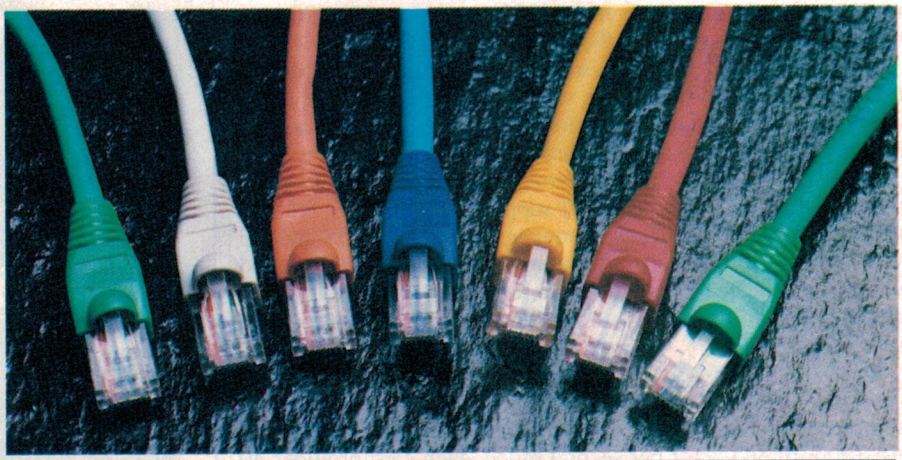
The software can control a turntable and antenna mast to allow fully automated testing.

For further information circle 243 on the reader service coupon or contact Dynamic Sciences, 614 Hawthorn Road, East Brighton 3187; phone (03) 596 0155. ❖

RJ45 cables and caps

Utilux has released a range of colour-coded patchcords with RJ45 plugs and caps fitted to each end. The cords feature gold plated contacts and come in two standard lengths of 1m and 2m. There are seven colours available, and the assemblies meet EIA/TIA, TSB36 and TSP40-4 standards. Also available is a new range of RJ45 coloured caps, which give an easy way to colour code data cables. These come in eight different colours and two sizes for either pre-assembly to RJ45 cables or for retrofitting to existing cables.

For further information circle 241 on the reader service coupon or contact Utilux, PO Box 68, Kingsgrove 2208; phone (02) 50 0155.



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New addition to TekTool range:

Tek handheld DSO samples at 500MS/s

Tektronix has made a number of additions to its 'TekTool' range of handheld instruments, possibly the most interesting of which is the new THS720 digital scope/DMM. This combines a high performance 500 megasample/second dual channel 100MHz DSO with a 3-3/4 digit true-RMS DMM, and offers features such as 600V isolation between input channels and an inbuilt RS-232C serial interface for a PC or printer.

by JIM ROWE

Early in 1994, test instrument maker Tektronix — for decades best known for its high quality oscilloscopes — launched a new series of attractively priced handheld test instruments under the heading 'TekTools'. First instruments in the new range were the TekMeters, which we reviewed in the May 1994 issue; these combine a 3-3/4 digit DMM with either a one- or two-channel 25MS/s DSO, and are very suitable for industrial electronics work.

Shortly after the TekMeters were released, Tektronix also announced its new range of high end TDS700A bench-type DSOs, with greatly enhanced acquisition performance and display speed/accuracy, as a result of Tek's newly developed 'TruCapture' and 'InstaVu' technology — embodied in some impressive new VLSI chips.

It seemed likely to be only a matter of time before Tek would be able to take advantage of this same new technology in its TekTool range. And that's exactly what has now happened, with the new THS700 series of 'TekScope' DSOs. Thanks to Tek's new technology, these offer a level of performance previously only available from full benchtop digital scopes, in a compact and very portable form.

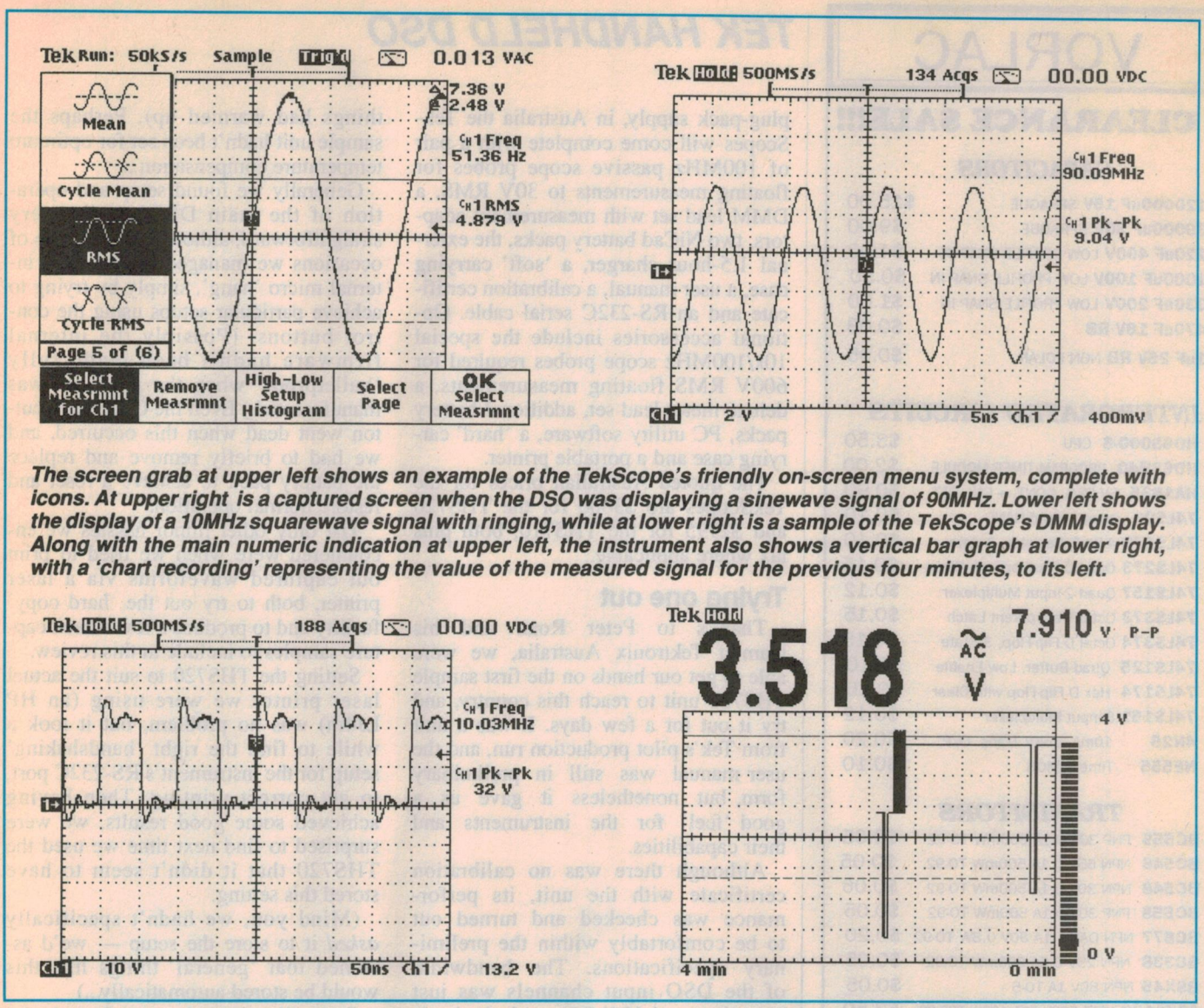
There are two models in the new range: the THS720 with an impressive maximum sampling rate of 500MS/s, a bandwidth of 100MHz and a top timebase speed of 5ns/div; and the THS710, with a maximum sampling rate of 250MS/s, a bandwidth of 60MHz and a top timebase speed of 10ns/div.

Both are dual-channel instruments, and in each case also provide a 3-3/4 digit autoranging DMM function with true-RMS AC modes, and its own inputs. They also have an inbuilt RS-232C serial port capable of driving a printer or interfacing with a PC.

Although both the existing TekMeters and the new TekScopes combine DSO and DMM functions, the new instruments undoubtedly place greater emphasis on the DSO facilities. Despite the compact package, they're essentially a fully-featured DSO with added DMM functions. Just about every feature you'd expect to find on a benchtop instrument is there, and with an order of performance to match.

For example, those maximum sampling rates rates are 'real time', not equivalent time. So they apply for single-shot pulse capture just as much as for repetitive signals, and since each channel can sample at the rate shown, there's no 'hidden reduction' when both channels are being used simultaneously. The fact that the real-time sampling rate is at least five times the analog bandwidth also gives a high degree of freedom from misleading 'aliases'.

This real-time performance, coupled with Tek's advanced triggering circuitry, also allows the TekScopes to capture glitches as brief as 8ns. And as you might expect, there's a full range of automated signal measurement facilities, providing fast information on everything from the signal's basic amplitude (peak-to-peak, RMS) and frequency (or period) to detailed parameters such as rise and fall time, duty cycle, overshoot and so on. Not to mention an 'auto range' button, to speed up instrument setup...



The screen grab at upper left shows an example of the TekScope's friendly on-screen menu system, complete with icons. At upper right is a captured screen when the DSO was displaying a sinewave signal of 90MHz. Lower left shows the display of a 10MHz squarewave signal with ringing, while at lower right is a sample of the TekScope's DMM display. Along with the main numeric indication at upper left, the instrument also shows a vertical bar graph at lower right, with a 'chart recording' representing the value of the measured signal for the previous four minutes, to its left.

In addition, the TekScopes offer a feature found on very few benchtop instruments: 'Isolated Channel' architecture, whereby both DSO input channels and also the DMM channel are independently isolated from each other and the rest of the instrument. This means that with matching high-voltage probes, each of the three input channels can be connected independently to circuit points that are 'floating' above true earth by as much as 600V RMS — making it possible to measure and display things like instantaneous circuit voltage and current, quite safely. Such measurements can even be made when the TekScope is connected to a printer or PC via the RS-232C port.

An important factor in allowing all of this scope 'horsepower' to be compressed into a handheld package is of course the use of a flat liquid-crystal display (LCD) panel in place of the traditional CRT. However the choice of LCD panel is critical with this type of instrument, because many LCDs provide a level of brightness, contrast, resolution and response speed which is markedly inferior to the performance of a CRT.

Happily Tek seems to have used an exceptionally good 120mm- diagonal backlit transmissive LCD in the TekScopes, with high brightness and contrast coupled with fast response. The display resolution is 320 x 240 pixels (W x H), and the backlighting intensity is typically 35cd/m^2 — bright enough for virtually all likely working environments (even direct sunlight). The display contrast is both temperature compensated and operator adjustable, too.

Like Tek's latest benchtop scopes, the TekScopes are very 'user friendly', thanks to an on-screen menu system with graphical icons and working in conjunction with a row of five software-defined buttons just below the display. Other buttons also interact with the menues, allowing you to set up the instrument easily for any desired trigger mode, measurement functions, hardcopy printer and so on.

Incidentally, the instruments provide 10 memories for instrument setups, and another 10 for storing captured waveforms.

Power for the TekScopes comes from a removeable 12V NiCad battery pack, which fits inside the rounded left-hand side of the case and is accessed via a round cap at the top left. A charging circuit is built into the instrument, working in conjunction with the matching plug-pack power supply.

The TekScopes will typically operate for at least 1.5 hours, from a charged battery pack. The packs can be recharged within 14 hours using the internal charger, or in 1.5 hours using an external NiCad charger. Apart from the

TEK HANDHELD DSO

plug-pack supply, in Australia the TekScopes will come complete with a pair of 100MHz passive scope probes for floating measurements to 30V RMS, a DMM lead set with measurement adaptors, two NiCad battery packs, the external 1.5-hour charger, a 'soft' carrying case, a user manual, a calibration certificate and an RS-232C serial cable. Optional accessories include the special 10x/100MHz scope probes required for 600V RMS floating measurements, a deluxe meter lead set, additional battery packs, PC utility software, a 'hard' carrying case and a portable printer.

The quoted Australian prices for the TekScopes are $3600 for the THS720 and $2995 for the THS710, both plus tax where applicable.

Trying one out

Thanks to Peter Roan and his team at Tektronix Australia, we were able to get our hands on the first sample THS720 unit to reach this country, and try it out for a few days. It was a unit from Tek's pilot production run, and the user manual was still in preliminary form, but nonetheless it gave us a good 'feel' for the instruments and their capabilities.

Although there was no calibration certificate with the unit, its performance was checked and turned out to be comfortably within the preliminary specifications. The bandwidth of the DSO input channels was just over the rated 100MHz, with the basic voltage and time measurement accuracy well within the rated +/-2%. Similarly the DMM accuracy seemed to be well within the rated +/- (0.5% + 5 counts), on all of the ranges we could easily check.

We found the instrument very easy to set up and use — in this respect it's at least as good as any DSO we've tried to date. The icon-assisted menu system and control buttons are quite intuitive, and of course the 'auto range' button is great for achieving a fast initial display with a new input signal.

The brightness and contrast of the instrument's LCD screen was very impressive, and on the whole a big improvement over most such displays we've used. We did however have to readjust the contrast setting manually to restore good contrast when the THS720 was turned on early one winter morning, when the ambient temperature had fallen (and then back again later, when things had warmed up). Perhaps the sample unit hadn't been set for optimum temperature compensation...

Generally we found setup and operation of the main DSO section very straightforward, although on a couple of occasions we managed to make the internal micro 'hang', simply by trying to achieve particular setups using the control buttons. (Possibly the internal firmware hadn't been made fully 'bulletproof' when the pilot run was manufactured.) Even the ON/STBY button went dead when this occurred, and we had to briefly remove and replace the battery pack to achieve a reset and restore normal operation.

The only other minor hassles we encountered were when we tried to print out captured waveforms via a laser printer, both to try out the 'hard copy' facility and to produce a few screen capture samples to include in this review.

Setting the THS720 to suit the actual laser printer we were using (an HP LJ4m) was no problem, but it took a while to find the right 'handshaking' setup for the instrument's RS-232C port, to get correct printing. Then having achieved some good results, we were surprised to find next time we used the THS720 that it didn't seem to have stored this setting.

(Mind you, we hadn't specifically *asked* it to store the setup — we'd assumed that 'general' things like this would be stored automatically...)

Overall, though, we found the THS720 TekScope a very easy instrument to use, both as a DSO and as a DMM. It delivers a very high standard of performance, too — so despite its compact form, there's no feeling of having sacrificed anything in order to achieve a 'handheld' instrument.

Quite the contrary, in fact. My feeling, after having used it for a few days, is that this instrument is very likely a preview of the future as far as scopes and DSOs are concerned. In the past, high-performance scopes have been bulky instruments, tied down metaphorically to a benchtop or trolley; but the THS720 shows us that in future, we'll be able to hold them in our hands.

Further information on the new TekScopes is available from Tektronix Australia, of 80 Waterloo Road, North Ryde 2113, phone (02) 888 7066 or fax (02) 888 0125; or from distributor Emona Instruments, which has offices in each capital city. ❖

LOW COST VIRTUAL INSTRUMENTS FOR PCs

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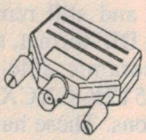
ADC-10



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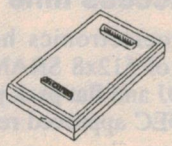
- *Chart Recorder Emulation*
- *Temperature Measurement*
- *Pressure Measurement*
- *Chromatography*
- *Research & Teaching*

ADC-16



- 8 Channel, 16 bit Plus Sign Inputs
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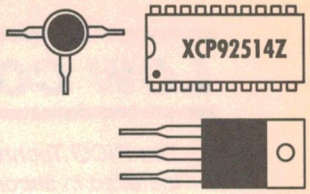
Solid State Update



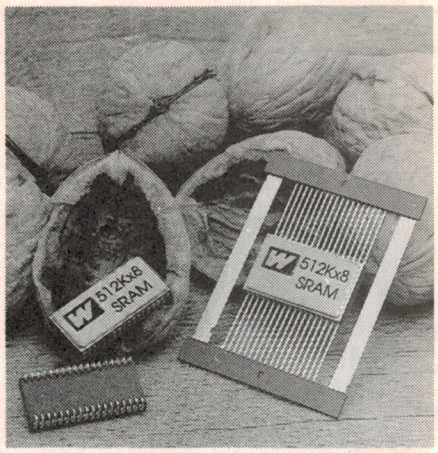
KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Four megabit SRAM has 17ns access time

White Microelectronics has introduced a range of 512x8 SRAMs in 36-pin ceramic SOJ and flat pack packages. Both have JEDEC approved revolutionary pinouts.

Both 4Mb products feature access times of 17 to 55ns, and meet a wide spectrum of performance based standard including MIL-H-38534 and MIL-STD-883. White is certified to MIL-STD-1772.

All devices feature low power CMOS design, TTL compatible inputs and outputs and 5V operation. At 25°C and 5MHz, maximum operating current is 100mA. In standby, the memories have a maximum standby current of 10mA. And because of their



rugged construction and small size, they offer the designer better mechanical stability in applications where acceleration, shock, vibration and space are major considerations.

For designers needing to upgrade 128x8 monolithic SRAM designs to the 512x8 and still remain in the standard 32-pin DIP format, there is also a 32-pin 0.6" ceramic side-brazed device, the WMS512K8-XCX for thru-hole applications. These have speeds of 17ns to 120ns and common specifications to the SOJs and flat pack devices.

For further information, contact White Microelectronics, 4245 E. Wood Street, Phoenix, AZ85040; phone (602) 437 1520.

Power transistor with a gain of 450

The Zetex ZTX105xA series of NPN power transistors for automotive applications can dissipate 1W of power at 25°C and 570mW at 100°C. The

Secure electronic locking for cars

National Semiconductor has announced the HiSeC rolling code generator, a device that generates encrypted signals for remote keyless entry (RKE) applications. HiSeC consists of a programmable logic device (available in S08 and S14 package sizes) holding National's patented coding scheme.

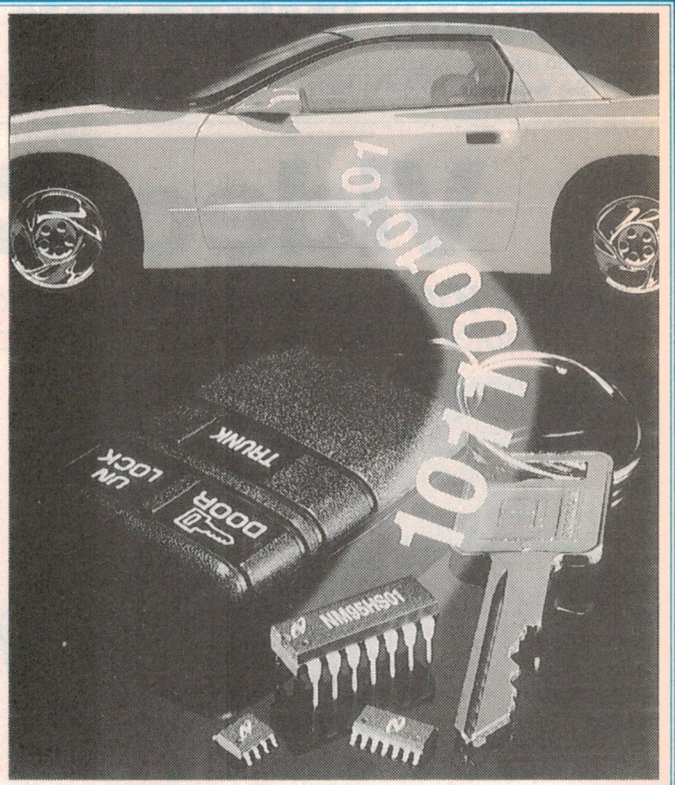
Unlike today's keyless entry products which send a fixed code signal, National's HiSeC generates a 'rolling' code signal. This means the device produces a different signal for each transmission, dramatically improving overall security.

For example, vehicles with keyless security systems are vulnerable to theft because the signal from the system can be intercepted. Therefore, when an owner leaves a car, the potential thief can simply replay the recorded signal to gain access to the vehicle.

To achieve its high security level, the HiSeC chip combines the contents of several dynamic data registers in a non-linear manner to produce an encoded output. Information in the registers consists of a mixture of user programmable data, factory programmable data and randomised data. This inherently random and separate data is encrypted by clocking it through a non-linear logic block and feeding part of the output back to produce a final coded output. Such coded output has a high degree of linear complexity and correlation immunity.

National sells HiSeC with a preprogrammed receiver as an off the shelf solution. As a result, a manufacturer does not need to invest engineering resources to understand the coding scheme's algorithm.

The device supports either an infrared or radio frequency signal transmitter, and can be clocked with either an RC clock or a crystal oscillator. It operates over a voltage range of 2.2V to 6.5V, and offers a low power stand-by mode for



battery applications. The low power stand-by mode provides a five year battery life in a typical application.

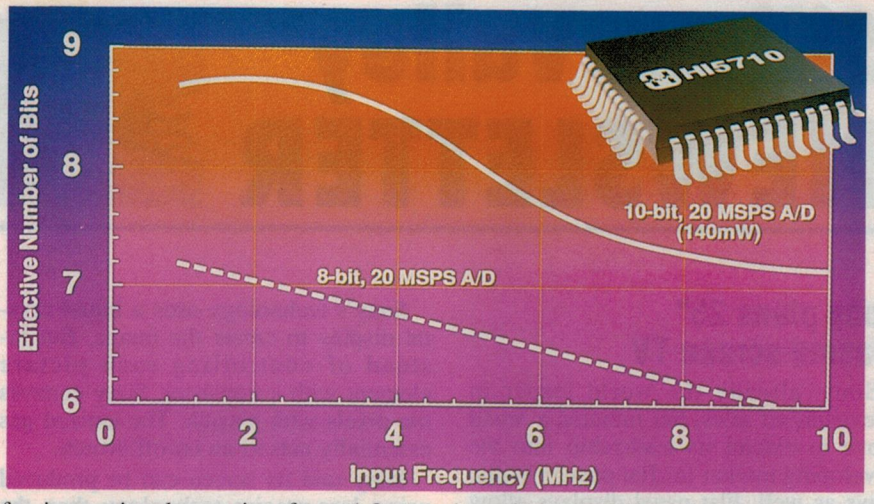
For further information circle 271 on the reader service coupon or contact National Semiconductor, Business Park Drive, Monash Business Park, Notting Hill 3168; phone (03) 558 9999.

10 bit ADC runs at 20MS/s

A 10-bit, 20 million sample per second (MS/s) throughput analog to digital converter (ADC) for digital video products has been released by Harris Semiconductor.

Called the HI5710, the ADC allows true eight bit AC resolution as required for RGB (red green blue) 24-bit true colour video, with four times oversampling of 4.5MHz video bandwidth signals. The new chip features low power operation (151mW max operating, with a 5mW power down mode) and the ability to drive either 5V or 3.3V logic.

The ADC's combination of high resolution and oversampling capabilities is intended to encourage a change from eight bit converters in applications such as video cameras, medical imaging systems and scanners. Additional applications include QAM (quadrature amplitude modulation) demodulators for television set-top boxes and high speed modems.



The device provides 10-bit output for input signals ranging from 1.8 to 5V, at a sampling rate of 20Ms/s. Full power analog input bandwidth (-1dB) is 70MHz, which translates into an extremely flat gain response at video frequencies. Typical signal to noise and distortion (SINAD) characteristics are 53dB at 1MHz, 54dB at 3MHz, 47dB at 7MHz, and 45dB at 10MHz. SINAD determines the effective number of bits (ENOB) of a converter, the actual resolution of which the chip is capable, taking noise into account. The 5710 maintains an ENOB above eight bits up to 5.5MHz.

For further information circle 272 on the reader service coupon or contact VSI Electronics, Unit C, 6-8 Lyon Park Road, North Ryde 2113; phone (02) 878 1299.

ZTX1053A has a minimum and typical current gain of 300 and 450, at a collector current and voltage of 1A and 2V, respectively. The transistor is rated at 75V (BV_{ceo}) and handles a collector current of 3A and a peak pulsed current of 10A. The ZTX1055A features pulse and continuous current ratings of 6A and 3A for driving relays, lamps and solenoids. The ZTX1056A combines the characteristics of the two devices and has a voltage rating of 160V.

For further information circle 275 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

PLDs offer ISP and JTAG

Altera Corporation has expanded the MAX 7000S family of programmable logic devices, by adding in-system programmability (ISP) and JTAG boundary-scan testing. The new devices are pin and programming file compatible with the existing MAX 7000 and MAX 7000E devices.

The ISP feature eases the engineering prototyping process as well as the manufacturing flow, because it eliminates the handling of devices during programming. ISP capable devices can be mounted on circuit boards using standard pick and place equipment and can then be programmed. Designers can then change a design if necessary. Additionally, ISP allows for remote field upgrades. The ISP feature of the MAX 7000s family complements Altera's patented chip-carrier technology, which allows today's MAX 7000 devices to be used with standard programming equipment.

The family is manufactured on a 0.5 micron, triple layer metal EEPROM process. This process was developed with Altera foundry partners to ensure high performance and 5V capability.

Altera has now added open collector outputs to the entire MAX 7000S product family. Open collector outputs are useful for active low signal requirements such as interrupt request signals.

For further information circle 273 on the reader service coupon or contact Veltek Australia, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

10-bit DAC is fast

The HI5721 is a new 10-bit, 125MHz digital to analog converter (DAC) for direct digital synthesis (DDS) in communications systems. It provides 25% more bandwidth, 45% lower power consumption, and substantially more dynamic performance (AC specifications) than its pin compatible counterpart, the 100MHz AD9721.

The 125MHz conversion rates move unwanted spurs and harmonics away from the fundamental frequency, which allows the use of less expensive filters. The DAC includes several dynamic performance measurements, including SFDR (spurious free dynamic range) to Nyquist, SNR (signal to noise ratio), SINAD (signal to noise ratio plus distortion), intermodulation distortion (IMD) and THD (total harmonic distortion).

For further information circle 276 on the reader service coupon or contact VSI Electronics, 6-8 Lyon Park Road, North Ryde 2113; phone (02) 878 1299. ❖

Silicon Valley NEWSLETTER

Sony plans 25" plasma screen TV

Sony, already the world leader in television set sales, has initiated a broad move to extend its leadership into the developing market for flat panel TV displays as well. Flat panel displays allow the TV set to hang from the wall like a picture or painting.

Sony officials said their company hopes to begin selling 25" flat 'plasmatron' TV sets before the end of the year.

While Sony has sold more than 100 million Trinitron TV sets, the company has fallen behind its competitors in the development of flat panel TV displays. The company is not even a participant in the fast-growing business of making liquid crystal displays for notebook computers.

To make up for lost time, Sony said it has turned to others to help develop its plasmatron display, which is based on technology from Tektronix of Wilsonville, Oregon. The plasmatron system combines liquid crystal and plasma display technologies.

Sony's technology uses a liquid crystal display to create the image. But instead of controlling each picture element with a transistor, Sony controls the pixels with plasma. The ionized gas essentially acts as an on-off switch.

Sony said its screen can be produced using less-precise technology than the advanced semiconductor technology needed for active-matrix liquid crystal displays. That should result in lower costs, but the company gave no information regarding costs or prices.

Microsoft aims at video game market

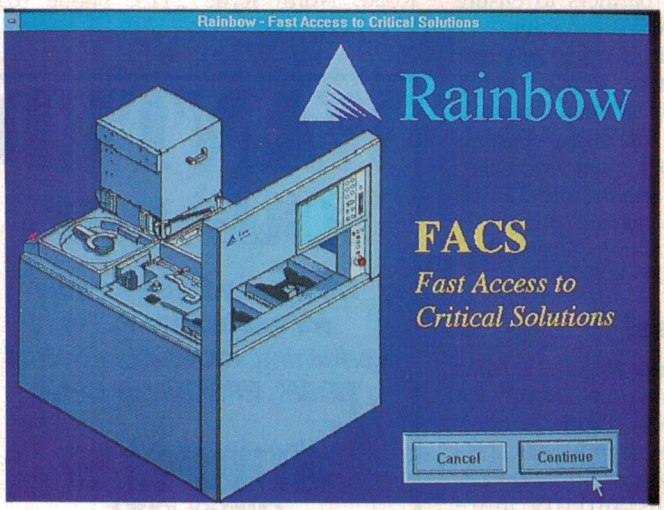
To users, it may be little more than a more user-friendly PC operating system. But increasingly, Windows 95 appears to be the platform from which Microsoft will wield an ever bigger and sharper axe, to fell competitors if not entire markets.

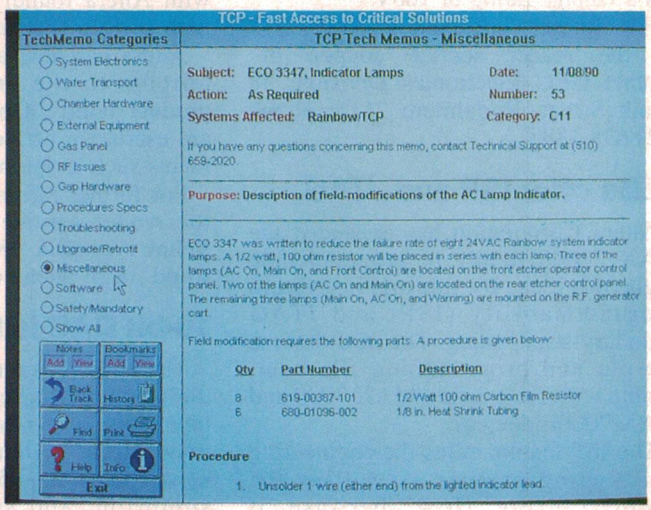
Already set to use Windows 95 as the vehicle for future dominance of the online information service industry, Microsoft has also taken steps to lever Windows 95 against the leaders in the US$10 billion video game industry. The company announced that it has set up a new joint venture with Softbank, Japan's leading business and entertainment software distributor.

Microsoft intends to blend Softbank's video game resources, including many leading titles, with its Windows 95 format to allows PC users to play video games on their multimedia PCs. Softbank will transfer the game titles to a PC CD-ROM format usable on Windows 95-based PCs.

Windows 95 provides a better environment for computer games than the current version of Windows, which has been all but ignored by game developers in favour of the older DOS operating system.

Mike Ribero, executive vice president of marketing for Sega of America, said he did not view personal computers as a threat. "Until you get a $149 multimedia PC I'm not worried", he said jokingly. "We believe PCs and video game platforms will go on parallel — not collision — courses," he said. "Do you really want your kids with their Cherry Cokes and popcorn populating





With Silicon Valley's chip manufacturing firms all operating at peak capacity, rapid repair of production equipment is of prime concern. In this context a new development announced by Etching Systems supplier LamResearch is of interest. The company has produced an interactive CD-ROM providing rapid access to its entire library of technical memos, to help its customers minimise equipment downtime. Shown here are the opening menu page and a typical illustration.

around your personal computer? I don't think so."

Amiga returns to US, yet again

The Amiga personal computer, like a cat with nine lives, is about to make yet another run for the vast US PC market after several tries during the past 12 years. In a recent surprise move, Escom, the German company that bought the remains of Commodore International and its Amiga line, said it plans to start manufacturing Amigas in the United States this year.

Trying to capitalise on the growing demand for multimedia PCs, Escom hopes the Amiga, which featured advanced multimedia capabilities years ahead of its competitors, will give consumers a viable alternative. The Amiga has been out of production for 18 months, but Escom's Edward Goff said he hoped to have Amiga 4000 models in production in less than two months.

Commodore went into liquidation in May 1994. Escom paid US$10 million for the company's core assets and technology in April. At that time, Escom President Manfred Schmitt said he wanted to resume production of all Commodore products in China if possible. Commodore had last done its manufacturing in the Philippines.

Petro Tyschtschenko, general manager of newly formed Escom subsidiary Amiga Technologies, said the Chinese would not be ready to begin manufacturing for at least a year. Tyschtschenko said that Escom wanted to produce 22,000 Amiga 4000's this year, and also 100,000 - 120,000 smaller Amiga 1200 systems for the European market.

Technology turns PC into a TV

En Technology has announced a 'breakthrough' consumer electronics product that it claims will link and transform the television and the personal computer. The product, codenamed 'Malachi', may have a revolutionary impact on the way news, information, advertising, software and consumer products are marketed and distributed.

Malachi will be available in the fourth quarter. It enables the transmission of a variety of information and multimedia data — ranging from promotional coupons to full-colour reproductions of magazines and software programs — via conventional television signals.

"Malachi represents one of the most significant steps forward for distribution and marketing to the consumer since the advent of television", said Patricia Gallup, president of En Technology. "The product allows the convergence of the two most powerful and popular entertainment and information technologies — the television and the personalcomputer."

Malachi users can select items they wish to receive from a menu that is broadcast to the computer. Users receive the items through any over-the-air, satellite or cable broadcast signal and can select and receive free program-related information while viewing their favorite shows. The multimedia items can be promotional, informational or educational, and include such things as graphics, animation, weather maps, photos, music lyrics, midi music files, QuickTime movies and 'sound bites'. In addition, they can also receive larger packages of information, such as software and upgrades, digital publications and all forms of multimedia packages.

The Malachi system includes an ISA board for the computer, a cable connecting the computer to the television and software — all of which can be installed in minutes by the end user. A second version of the system will include a TV tuner on the board. The anticipated retail price for the Malachi system is under US$100.

The board includes a two-chip set with individual identification numbers embedded in the chips. The numbers allow broadcasters to send targeted data directly to any individual Malachi user or specific group of users. The system has full encryption security built into the hardware and uses DES (Data Encryption Standard) encryption and decryption — the only data encryption methodology approved by the US Government.

MOTOROLA TOPS CONTROLLER MARKET

Motorola continues as the world leader in embedded microcontrollers, based on 1994 sales calculated in US dollars, according to a report by Dataquest. Motorola has approximately a 19% share of the worldwide microcontroller market, making it the second year Motorola has held the number one spot.

"Having the number one market share is a significant accomplishment, however we continue to work to increase capacity to support our customers and maintain market leadership in the microcontroller market", said Gary Daniels, senior vice-president and general manager of Motorola's Microcontroller Technologies Group.

No summer slowdown in Silicon Valley

When summer finally arrived in Silicon Valley, with temperatures hitting the 100°F level, it was still relatively cool compared to business conditions in the Valley's US$200 billion electronics industry. Unlike most years, this summer will see little or no relaxation for the Valley's half-million electronics workforce. Not when backlog ledgers are bulging, for products ranging from semiconductor production machinery to end-user PCs.

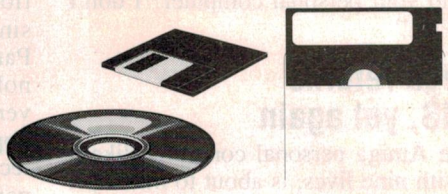
Already in its third year, the boom in the electronics industry is showing few signs of letting up. Chip output, which usually slows down to a trickle in the summer as most of the major markets around the world essentially close down, is running at full capacity, and even that won't be enough to satisfy demand.

Order rates for semiconductors continue at record levels. Fears for a significant drop in orders has given away to fears the industry may not be able to meet demand for one or two more years, as new capacity is coming on line only slowly. New facilities coming on line now are the result of expansion decisions made two years ago, at a time when caution about a new recession in the semiconductor industry was on the minds of most chip industry executives.

Now, rather than a recession, market forecasters see the chip market tripling to a seemingly unbelievable US$300 billion in 2000. That will require huge investments in new plant and equipment. Already more than 90 new semiconductor plants or major expansions of existing facilities are in different stages of planning or building. But even that may not be enough to meet the exploding demand for semiconductors.

Chip industry executives explained that their growth will be driven not just by booming personal computer sales, but by demand for cellular phones and other wireless communications, digital imaging displays, and automobile technology — removing the former volatility of an industry once dependent on personal computer sales alone. ❖

SPOTLIGHT ON SOFTWARE



Picture Publisher 5.0

In the Windows environment, Micrografx's *Picture Publisher* is undoubtedly one of the most popular image editing packages. Recently it was upgraded to version 5.0, and it's now also being sold in a CD-ROM bundle along with *Micrografx Designer 4.1TE* technical drawing package and *Kai's Power Tools*, for a very attractive price.

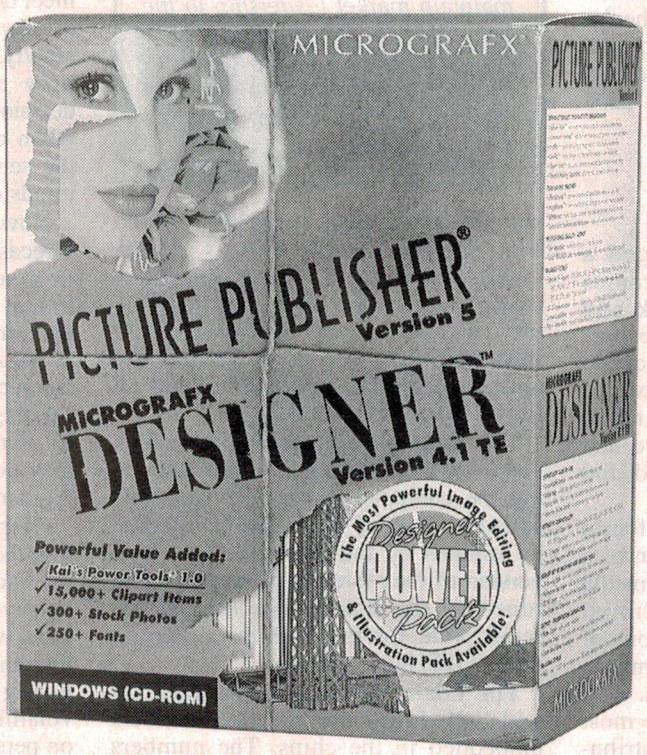
by JIM ROWE

When I reviewed version 4.0 of *Picture Publisher* for our June 1994 issue, I was pretty impressed. V4.0 was a major upgrade from the previous version, and had been given many enhancements and new features. For someone like myself who had already been quite happy with V3.0, it was hard to imagine how they could make the package much better.

Perhaps the Micrografx software engineers had a similar problem, because I'd describe the new V5.0 upgrade as rather less dramatic than the previous one. There are still quite a few new and very worthwhile enhancements, but they're just not as salient as before. I guess it's an example of the difficulty in making major improvements to any product, when you've already made it quite good...

You still have all of the existing *PP* image editing and manipulation goodies, of course, plus the added enhancements which came with *PP4* — like Object Layers, to remove the 'get it right or start again' factor when you're pasting image elements or text into an existing image; LoRez Image Open and FastBits, to make it easier to edit large image files; and the ability to perform eight-bit masking, and also support the same effects 'plug-ins' available for packages like Adobe *Photoshop*. Again you still have those nice things such as EffectsBrowser, which lets you preview the effect of 'global' image editing functions like Sharpen, before you apply them; and a choice of either 'joystick' or 'visual' methods of adjusting image contrast/brightness, or colour balance.

Probably the most visible of the new enhancements with *PP5* is a feature known as Command List Processing, which is a development from the Macro facility provided in *PP4*. It's a system of transparently attaching to the image file format used by *PP5* an ASCII record of the editing that has been applied to the image — allowing the editing to be 'undone' if desired, even after the edited file has been saved.



As well as providing *PP5* with an effectively 'infinite undo' facility, Command List Processing also gives other advantages. For example you can re-arrange the order of editing steps, if you realise that they'd be better done in a different order, or add new steps. Or you can use the LoRez editing mode to achieve the desired enhancements to a low-resolution version of a large image file, and save the LoRez image with the Command List attached; then at some later time you can open the full high-res version, apply the Command List and have *PP5* perform the same editing to the full image. In short, the Command List is a kind of editable 'Super Macro', in addition to the existing macro facility.

Other new enhancements with *PP5* include:

- Bubble Hints: If you position the mouse cursor over any on-screen button or icon, a small yellow 'bubble hint' will pop up to remind you of that button/icon's function. A nice feature, which *PP5* now shares with other late-version Windows based packages.
- Customisable Toolboxes There's now the ability to create your own custom 'floating toolbox' windows, with frequently-used tools and macros readily accessible.
- Power Right Mouse Button: When you're using any of the main image editing tools, the right-hand mouse button now gives

you access to that tool's selection submenu.

- Keyboard 'hot keys': There are now keyboard shortcuts for a very wide range of *PP5* functions, to speed things up when you're familiar with the package.
- Chroma Mask: A new masking tool which lets you accurately mask out backgrounds, deleting even the fringing around outlines. Masks can also be edited directly, as grey-scale images.
- Extensive OLE 2.0 support, to allow *PP5* images to be linked into DTP, word processing, spreadsheet, or other files in a 'drag and drop' fashion. The image remains in *PP5* format, and can still be edited.
- Support for vector-based drawing file formats as well as the existing bit-mapped image formats. Additional file formats now supported include EPS (AI), CDR, DRW, CGM and WMF. In combination with the Object Layers facility, this allows *PP5* to be used interactively with a drawing package such as Micrografx's own *Designer*, or the very popular *Corel Draw!*, to get full benefits from both.
- Integrated Colour Management System: *PP5* now comes with Kodak's widely-used Precision Colour Management System included, to ensure consistent colour balancing from scanner, to monitor screen and printer/imagesetter.
- Larger previews: many of the effects can now be previewed more accurately, as the preview windows have been enlarged.
- It now directly supports an increased number of image scanners, along with those that use the Twain interface.

In addition, the CD-ROM version of *PP5* also comes with an interactive 'on line' tutorial program, to speed up one's learning of this now very powerful package. There's also an improved 'quick reference' folder, which provides not only summaries of the basic editing tool usage, but also handy things like scanner/printer calibration procedures, suggesting scanning resolutions and a listing of keyboard shortcuts. Very handy!

As mentioned earlier, *Picture Publisher 5.0* is now being offered not only alone, but also as part of a Micrografx 'Designer Power Pack', along with *Designer 4.1TE Technical Illustrator* (reviewed by Peter Phillips in the July issue) and *Kai's Power Tools 1.0* — a set of 33 image enhancement and filtering plug-ins for image editors like *PP5*, providing additional effects such as complex gradient fills, Julia and Mandelbrot set 'chaos' effects, '3D noise' transformation, directional smudging, the 'glass lens' distortion, and 'pixel storm' random atomisation. Also included in the Power Pack package are over 15,000 clipart images, 300+ stock photo images and 250+ fonts.

With all of these goodies, the Designer Power Pack is therefore a very powerful package. It's available only on a CD-ROM, but at a price of only $245 it surely provides exceptional value for money. Upgrades from registered earlier versions of either *Picture Publisher* or *Designer* are available for only $145 plus $10 for handling and postage. *Picture Publisher V5.0* is available alone as a floppy-disk version for $245 (as also is *Designer 4.1TE*).

Trying it out

I've been using *Picture Publisher* fairly regularly since early in 1992, having started with *PP3* and upgraded to *PP4* last year. So I'm both familiar with the basic package, and perhaps also a bit blase about it. However I was still very interested in trying out the new version, if only to see how they'd managed to improve a package that was already very powerful and easy to use.

Having just upgraded to a new 90MHz Pentium-based machine, it was appropriate to install *PP5* on this machine even though this made it harder to judge the new version's relative speed of operation. However judging from the very significant speedup in image redrawing as well as file loading and saving, it seems fairly safe to conclude that *PP5* is not noticeably slower than its predecessor. Virtually all operations are now very much faster on the Pentium machine (which has 16MB of RAM and a Diamond Stealth 64 video card), and some are close to instantaneous. For example if you blink, it's easy to miss the application of a new effects filter...

After using the new package for a few weeks now, I have to admit that it's not only more powerful than *PP4*, but if anything even easier to use. Some of the new enhancements are mainly going to be noticed by the professional user manipulating images every day, but they're there nonetheless. And others, like the 'unlimited undo' facility provided by the new Command List system, are going to be mighty handy for the rest of us who don't do enough image editing to get really proficient at it.

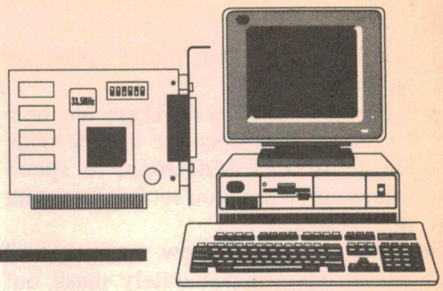
That ability to mix vector drawings and bit-mapped images is also going to be very handy, for technical magazines like *EA*...

In short, *Picture Publisher 5.0* is now an exceptional imaging editing package, particularly at the new low price.

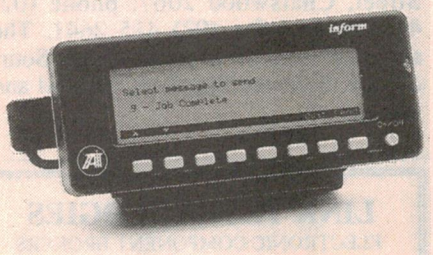
By the way, Micrografx has also announced a version of *PP5* for Windows 95, in 'Beta' form. This is being offered to all registered Windows 95 beta users for $45 plus handling, and can be ungraded to the final release version within 30 days of the release of Windows 95.

Further information is available from Micrografx Australia at Level 7, 10 Help Street, Chatswood 2067; phone (02) 415 2642 or fax (02) 415 2641. The software itself is available from Sourceware, Software Suppliers, Merisel and Proscan. ❖

Computer News and New Products



Mobile text despatch system



Tait Electronics has released its first fully integrated mobile voice and data despatch system. Called Inform, the system is the first in a planned series of off-the-shelf data despatch products.

The manufacturer claims that there is already a lot of interest in the system from organisations wanting to upgrade from two-way voice communication to data despatch. According to Lionel Earle from Tait: "Using traditional mobile radio, sending messages to a driver over a voice channel can take minutes and runs the risk of human error. With Inform, over 100 messages can be transmitted instantly, and are recorded even if the vehicle is unattended."

Inform despatch software runs under Windows, and is connected to the trunking network through an MAP27 compatible radio, like the Tait T2040. The software features a standard graphical user interface and a single screen workspace where messages are generated, sent and received. Each mobile operator has an Inform text terminal and a data capable radio. The received information remains in the system until the driver deletes it.

For further information circle 180 on the reader service coupon or contact Tait Electronics on 1800 077 112.

'Natural' keyboard

Rod Irving Electronics is now stocking the Microsoft Natural Keyboard for IBM-compatible PCs, designed to allow more comfortable operation by naturally positioning and supporting the operator's hands, wrists and forearms. The design apparently emerged following extensive research into human ergonomics.

The split, gently sloping keyboard has a 'mound' in the centre to match the natural position of the hands, while a built-in palm rest provides hand support to encourage a relaxed posture. A fold-down 'wrist leveller' allows adjustment for various desk heights.

The keyboard is provided with additional keys, to provide added functions when the keyboard is used with a computer running Microsoft's Windows GUI (Version 2.0 or later).

Matching IntelliType software is provided with the keyboard, to enable the additional functions. The RIE catalog number for the Microsoft Natural Keyboard is X12029, and it carries an RRP of $175.95.

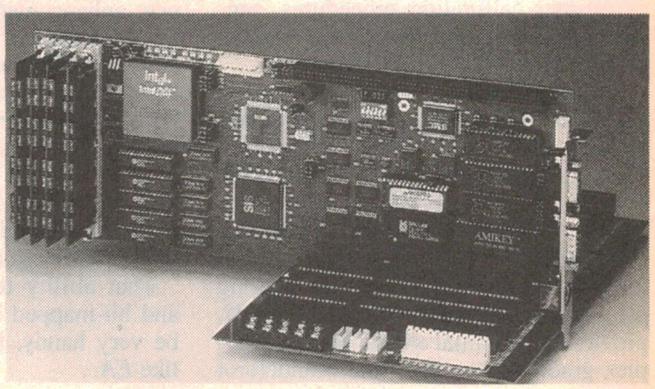
Industrial quality '486 CPU card

The PCA-6147 from Advantech is an industrial quality single board computer that supports a range of '486 CPUs. These include the '486SX, DX, DX2 and DX4 in 25, 33, 40, 50, 66, 75 and 100MHz speeds. An on-board DC/DC converter auto switches the voltage to 3.3V if it detects a DX4 CPU.

The card features four 72-pin DRAM sockets that support up to 64MB of on-board DRAM. It includes 256KB of cache, IDE HDD/FDD controllers, a watchdog timer, a 1.44MB flash/ROM disk, one RS- 232 and one RS-232/422/485 (jumper selectable) serial port and an enhanced bi-directional parallel port that supports ECP and EPP.

The on-board solid state disk enables bootup and program execution without an external drive. The watchdog timer can reset the CPU or generate an interrupt if program execution is halted, making the card suitable for unmanned or remote applications.

For further information circle 161 on the reader service coupon or contact Priority Electronics, Suite 4 & 5, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266.



It is available from all Rod Irving Electronics outlets.

Assembly language text editor

Oztechnics has released a new text editor specially designed for editing and debugging assembly language programs. The editor integrates all Oztechnics software development tools under one working environment.

The editor includes all the normal text editing features such as cut/copy/paste, undo and search/replace. It also supports a mouse, book marks (to mark a page to return to), a print file and includes a context sensitive help file.

Of particular use to programmers is the comprehensive on-line technical data for Motorola microcontrollers. There's also an integrated cross assembler, an integrated simulator (68SIM05) and an integrated programmer (68PROG05). During the assembly process, the editor captures the output of the cross assembler and displays an error log in a separate window.

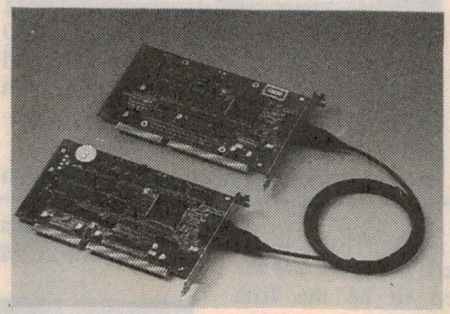
To make debugging easier and quicker, the cursor in the edit window can be automatically positioned to the lines within the source code that have been flagged by the cross assembler.

For further information circle 165 on the reader service coupon or contact Oztechnics, PO Box 38, Illawong 2234; phone (02) 541 0310.

Optical ISA-bus expansion kit

The PCX-797 optical expansion kit allows additional ISA-bus slots to be linked to an existing system. The standard kit consists of two half-sized PC/AT add-on cards: a master card for the PC and a slave card for a remote passive backplane.

A fibre optic cable transmits bus signals between the two cards, ensuring fast interference-free communication. The kit is designed for industrial automation and communication applications which require a large number of additional slots for I/O add-on cards. Multiple master cards can be installed in a PC, allowing hundreds of extra I/O slots to be added to a system.



The bus throughput speed is 1.6MB/s, and features a 96Mb/s optical transmission rate. The kit comes with a two-metre length of fibre optic cable, but supports any cable length up to 100 metres.

For further information circle 166 on the reader service coupon or contact Priority Electronics, Suite 4 & 5, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266.

15" monitor has touch screen

The GM-1563 is a high quality MPR-II green monitor with an integrated touch screen. The monitor has a 15" flat screen, with a 0.28mm dot pitch, a maximum resolution of 1280 x 1024, and has digital controls. The monitor bandwidth is 100MHz, the vertical scanning frequency ranges from 44Hz to 100Hz, and the horizontal scan frequency has a range of 30kHz to 64kHz.

The touch screen controller is built into the monitor and is connected to a PC with

an RS-232 cable. The unit is supplied with drivers for Windows 3.1x and emulate a mouse, allowing programs that have a mouse interface to work with the touch screen without modification.

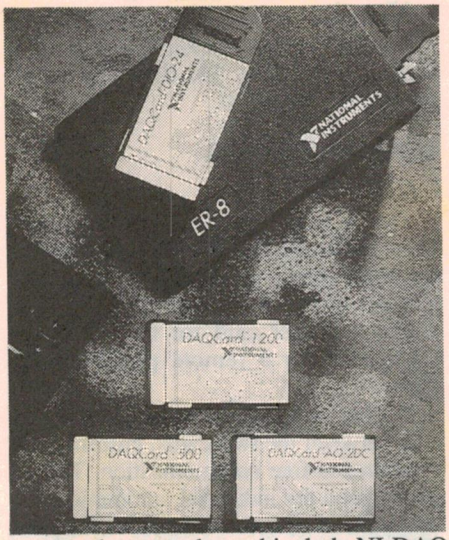
The touch screen has a maximum resolution of 1024 x 1024 and can be actuated with a pen or finger. The monitor also has integrated speakers giving video, touch and audio in one unit.

For further information circle 168 on the reader service coupon or contact Click Electronics, 29 Bachell Avenue, Lidcombe 2141; phone (02) 649 6011.

PCMCIA data acquisition cards

National Instruments has announced four new Type 2 PCMCIA cards for data acquisition and control applications. The cards are designed to be used with a notebook computer for portable test and measurement and process monitoring and control applications.

Called DAQCards, they feature a



power-down mode, and include NI-DAQ version 4.8 driver software for DOS and Windows. The cards are compatible with National's LabView and LabWindows/CVI application software.

For further information circle 164 on the reader service coupon or contact National Instruments, PO Box 466, Ringwood 3134; phone (03) 879 9422.

10-bit A/D card samples at 70MHz

Pentek has released a dual channel, high speed 10-bit analog to digital converter board that operates at sampling rates up to 70MHz. Dubbed the 6472, the card is a single slot 6U VMEbus board featuring both signal conditioning and clock generation circuitry.

The card has two Analog Devices 9060 A/D converters and provides front panel access directly from a receiver or DSP system through standard flat ribbon cable. The converter is optimised for real-time radar signal analysis, communications monitoring, digital down-conversion and high speed modems.

For further information circle 162 on the reader service coupon or contact Scientific Devices, 2 Jacks Road, South Oakleigh 3167; phone (03) 9579 3622.

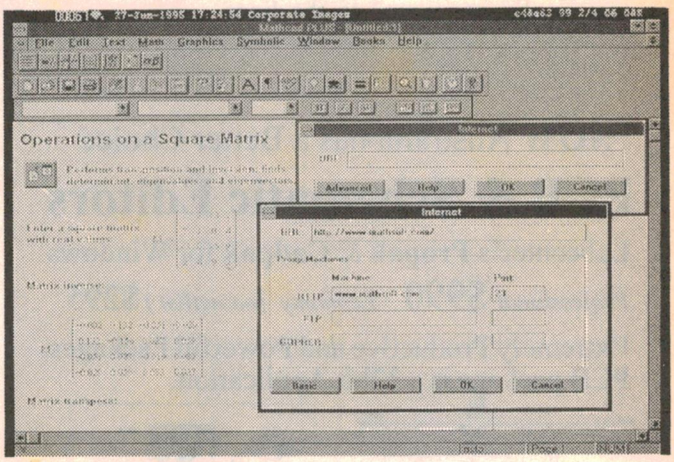
Maths software

Hearne Scientific Software has released Mathcad 6.0 for Windows. The new version is claimed to be the first package of its type to combine World Wide Web connectivity, groupware, messaging, authoring features and powerful mathematical, science and engineering calculation tools in a single environment.

The Mathcad screen is like a scratchpad where mathematical equations, text and graphics can be entered. The numerical and symbolic processor engine is capable of handling complex calculus, matrix and array functions and transforms, as well as simple mathematical calculator-type problems.

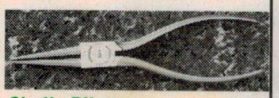
The software also supports all popular LAN based e-mail systems, as well as Lotus Notes. A unique feature is the ability of the software to embed and follow hotlinks between Mathcad worksheets located on the WWW and in Lotus Notes databases, forming a powerful global framework for sharing and collaborating on technical information.

For further information circle 167 on the reader service coupon or contact Hearne Scientific Software, Level 6, 552 Lonsdale Street, Melbourne 3000; phone (03) 602 5088. ❖



Technicians Tool Corner

We are always on the look out for special tools to make the technician's life a little bit easier – take a look at these...



Circlip Pliers

Do you enjoy fiddling with circlips? Well we have found some beaut circlip pliers, from Italy. These have straight jaws and are chromium plated over chrome vanadium steel. They're intended for internal clips. High quality at **$24.40.**

Spring Puller

How many times have you struggled to get a spring out of a piece of equipment and then spent what seems like eternity trying to get it back?!!

Well we've found the answer a special Spring Puller – again from Italy!. Made in chrome vanadium steel it has a hook shaped tip at one end and a fork-shaped tip at the other. It's 210 mm long for easy reaching into equipment and will certainly save you a lot of *?*!!#!#**!!.

Value at **$18.50**

Cases for Callers Only

We get requests for technician's toolcases and have located some moulded leathergrain embossed ABS plasic cases. Two types – both include document file and tool pockets in the lid and a moulded base tray divided into compartments for storing meters, soldering iron, spare parts, extra tools etc. They have strong aluminium frames, a sturdy handle and recessed Appollo locks. All fittings are nickel plated. Unfortunately they are too awkward to mail, so please call in!

Model TC04 measures 470x345mm (internal), 480x360x155mm (ext) **$170.00**

Model TC01 measures 460x320mm (internal), 480x335x130mm (ext) **$150.00**

Crystals

CRYS-32KHZ	32kHz Crystal	$0.85
CRYS-1.00MHZ	1MHz Crystal	$15.75
CRYS-1.84MHZ	1.8432MHz Crystal	$8.20
CRYS-2.00MHZ	2MHz Crystal	$4.20
CRYS-2.45MHZ	2.4576MHz Crystal	$3.75
CRYS-2.50MHZ	2.5MHz Crystal	$4.60
CRYS-3.48MHZ	3.48MHz Crystal	$2.55
CRYS-3.58MHZ	3.58MHz Crystal	$2.50
CRYS-3.608MHZ	3.60864MHz	$2.15
CRYS-4.00MHZ	4MHz Crystal	$1.60
CRYS-4.00MHZ-LP	4.0MHz L Prof	$2.75
CRYS-4.19MHZ	4.19MHz Crystal	$2.85
CRYS-4.43MHZ	Colourburst Crystal	$2.20
CRYS-4.92MHZ	4.9152MHz Crystal	$2.60
CRYS-5.0MHZ	5MHz Crystal	$3.00
CRYS-5.06MHZ	5.068MHz Crystal	$2.20
CRYS-6.00MHZ	6.00 MHz Crystal	$3.70
CRYS-6.14MHZ	6.144 MHz Crystal	$4.00
CRYS-8.00MHZ	8MHz Crystal	$3.45
CRYS-9.83MHZ	9.8135MHz Crystal	$3.45
CRYS-10.00MHZ	10MHz Crystal	$2.30
CRYS-11.98MHZ	11.98135MHz	$2.60
CRYS-12.00MHZ	12MHz Crystal	$2.20
CRYS-14.301MHZ	14.301818 MHz	$2.60
CRYS-16.00MHZ	16MHz Crystal	$2.30
CRYS-20.00MHZ	20MHz Crystal	$2.30
CRYS-24.00MHZ	24MHz Crystal	$3.90
CRYS-25.00MHZ	25MHz Crystal	$3.90
CRYS-27.14MHZ	27.145 MHz	$2.60

Crystal Oscillators

CRYS-OSC-7.98MHZ	7.9872MHz	$12.45
CRYS-OSC-8MHZ	8MHz	$12.40
CRYS-OSC-12MHZ	12MHz	$13.15
CRYS-OSC-16MHZ	16MHz	$12.40
CRYS-OSC-20MHZ	20MHz	$8.60
CRYS-OSC-32MHZ	32MHz	$12.40
CRYS-OSC-66MHZ	66MHz	$10.30

Wood For Chips – Bridges & Micros!

We started the full semiconductor listing back in October. Call us if the device you want isn't listed!

Bridges & Diodes

BR64-BRIDGE	400V 6A Bridge	$2.10
BR104-BRIDGE	10A 400V Bridge	$3.60
BR100/03	32V 2A Diac	$0.90
IG4B41	400V 1A Bridge	$1.15
FR604	400V 6A Fast Rec.	$1.30
KBL04	400V 6A SIL Bridge	$2.30
KBL3504	400V 35A Bridge	$4.75
MB1505	50V 15A Bridge	$4.20
MBR745	7.5A 45V Schottky	$1.50
MBR1045	10A 45V Shtky	$1.85
W04M	400V 1.5A Bridge	$0.60
W150	See BR104	
1N60	Germanium Diode	$0.65
1N914	See 1N4148.TR	
1N3070	200V 150mA Sw.	$0.15
1N5060	400V 2A Avlnch.	$0.45
1N4007	1000V 1A Diode	$0.10
1N4007-LF	1000V 1A Formed	$0.05
1N4148.TR	100V 4nS Sig. D.	$0.05
1N4936A	See 1N4937RL	
	600V Type	$0.65
1N4937RL	600V 1A Fast Rcvry	$0.20
1N5397RL	600V 1.5A Diode	$0.15
1N5408	1000V 3A Diode	$0.30
1N5821	30V 3A Schottky	$1.20
1N5819	40V 1A Schottky	$0.80
1N5822	40V 3A Schottky	$1.00
1N5823	20V 5A Schottky	$1.30
5082-2800	Hot Carrier Schtky	$1.70
5082-2835	Schottky Diode	$1.65
A14F	50V/1.5A Avlch	$0.15
BAV21	200V 250mA 50nS	$0.15
MR851	100V 3A 200nS	$0.80
MR856	600V 3A 200nS	$1.00
BYV27-200	200V 2A 25nS	$1.05
BYV28-200		$1.10
BYW29-100	100V 8A Fast Rcvry	$2.65
BYW29-150	150V 8A Fast Rcvry	$2.50

Processors

6502AP	8 Bit Processor	$10.15
65C02	8 Bit Processor	$16.70
6505	8 Bit Processor	$18.70
6512	8 Bit Processor	$7.45
6520A	8 BIT P.I.A.	$11.65
6521	8 BIT P.I.A.	$11.00
6522	8 BIT P.I.A.	$13.15
65C22P	8 BIT P.I.A.	$17.15
6551-27	A.C.I.A.	$9.30
6800P	8 Bit CPU	$14.65
6802P	8 Bit CPU + RAM	$8.45
6803P		$11.85
6809P	8/16 Bit CPU	$10.15
6821P	P.I.A.	$5.80
68B21P	P.I.A.	$7.45
MC68B44P	MPU	$15.85
6852P	S.S.D.A.	$12.00
6840P	Progr Timer	$7.65
68B40P	Progr Timer	$12.65
68B44P	DMA Controller	$80.85
6845P	CRT Controller	$8.30
68B45P	CRT Controller	$16.20
6847P	Video Disp Gnrtr	$30.85
6850P	A.I.A.	$7.45
68B50P	A.I.A.	$10.15
6875P	2 Phase Clk Genr	$18.65
8032AH		$7.45
82C51A2RS	CMOS 8251	
8253P-5	Timer/Counter	$18.80
82C53ARS-5-9	CMOS 8253	$20.30
82C55A-5-P	Prog Periph. Ifce	$10.205
8259A	Interrupt Contr	$13.80
146805EP	8 Bit CMOS CPU	$18.90
HD64180RCP8X		$34.15
68000-CP16	16 Bit CPU	$40.40
68705P3S	8 Bit CPU,3.7K EPROM	$35.70
D82C501	Ethernet Ser Infce	$64.25
EF68B40P	See 68B40P	
MC68705P3	See 68705P3	$26.45
MC146805E2P	CMOS Romless	$12.00
NSC800N-1	Until Sold	$12.05
PCB80C55216WP	16MHz Micro	$32.15
PCF80C55216WP	8 Bit uP + 10 Bit A/D	$44.10
P8255A	Pgmbl Periph. Ifce	$11.05
P82586	LAN Coprocessor	$89.15
SC80C31BCCN40	12MHz ROMless microprocessor	$14.55
V30	Improved V20	$30.00
Z80A-CTC	See Z80B-CTC	
Z80A-DART	See Z80B-DART	
Z80A-DMA	See Z80B-DMA	
Z80A-PIO	See Z80B-PIO	
Z80A-SIO/0	See Z80B-SIO/0	
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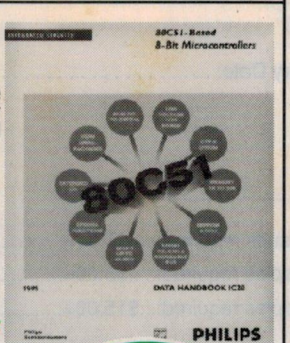

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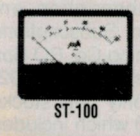
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We are now stocking the US-made Richmond Technology range of Anti-Static Products. Anyone dealing with servicing of static sensitive components and circuit boards will be all too well aware of the damaging effects of electrostatic discharge. The Richmond range includes –

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KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

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NEW Brand new high quality motor driven potentiometer, like those used in commercial stereo sound systems. Includes a clutch, so can also be manually adjusted. Standard 1/4" shaft, stereo (dual 100k pots) with 5V, 20mA motor. Special introductory price **$15**

A low cost UHF remote control kit for this unit will soon be available. Add a remote controlled volume system to an old TV or stereo. The controller can also be used to drive electromechanical devices via relays. Kit includes commercial 2-ch UHF Tx, Rx module, PCB motor-driven pot *or* relays, PCB and all on-board components. Approx price **$50!!**

MORE ITEMS & KITS

Poll our **(02) 579 3955 or (02) 579 4985** fax numbers to find out how to get our item and kit lists. MANY MANY MORE ITEMS AND KITS THAN THOSE LISTED HERE! *Ask for these lists to be sent with your next order.*

KITS

SINGLE CHANNEL UHF FOR CENTRAL LOCKING

NEW Our single channel UHF receiver kit has been updated to provide provision for central locking!! Key chain Tx has SAW resonator, see SC Dec 92. Compact receiver has pre-built UHF receiver module, and has provision for two extra relays for vehicle central locking function. Kit comes with two relays. **$36** Additional relays for central locking **$3** ea. Single channel transmitter kit **$18**

MASTHEAD AMPLIFIER SPECIAL High perfomance low-noise masthead amplifier covers VHF-FM-UHF and is based on a MAR-6 IC. Includes two PCBs, all on-board components. For a limited time we will also include a suitable plugpack to power the amplifier from mains for a total price of: **$25**

PROTECT ANYTHING ALARM KIT EA May 93, PCB and all on-board components *ON SPECIAL* **$20**

4-CHANNEL UHF REMOTE CONTROL KIT: Two Tx & 1 Rx **$96.**

LASER BEAM COMMUNICATOR KIT: Tx, Rx, plus IR laser: **$60**

FM TRANSMITTER KIT - MK1 This complete transmitter kit (miniature microphone included) is the size of an AA battery, and is powered by a single AA battery. Use a two AA battery holder (provided) as the case, and a battery clip (shorted) for the switch. Battery life is over 500 hours!! **$11**

BRAKE LIGHT INDICATOR KIT: 60 LEDs, two PCBs and ten resistors, makes a very bright 600mm long, high intensity red display **$25.**

GARAGE DOOR - GATE REMOTE CONTROL KIT: SC 4/94 Tx **$18**, Rx **$79.**

1.5-9V CONVERTER KIT: $6 ea. or 3 for **$15.**

PLASMA BALL KIT: PCB and components kit, needs any 240V light bulb *ON SPECIAL* **$20.**

COMPONENTS

HIGH VOLTAGE DISC CERAMICS 680pF/3kV **20 for $4,** 15nF/3kV **$2,** 1nF/15kV **$4**

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HIGH INTENSITY RED LEDS 550 - 1000mCd @ 20mA, 100mA max, 5mm: **10 for $4 or 100 for $30**

BLUE LEDs 5mm **$2.50**

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HE-NE LASER red laser tube plus 12V universal laser power supply kit at ridiculous prices. Used 3mW tube and 12V supply kit **$65.** 6mW tube and supply kit **$170**

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3-STAGE STARLIGHT TUBES Fibre optically-coupled image intensifiers with a minor blemish. Kit includes EHT supply kit, lens, eyepiece **$250** *Almost a complete starlight viewer!*

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We can also provide two thermal cut-out switches and a 12V DC fan to suit either device **$10**

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HALL EFFECT SWITCH Solid state switch that reacts to the proximity of magnetic fields. Runs at extremely high speeds, up to 100kHz. Operates from 4.5 to 24V DC supply with 10mA sink-type digital output. Supplied with a suitable magnet. **$2 ea. or 5 for $8**

HALOGEN TRANSFORMER Compact (41x66x30mm) metal cased electronic transformers, 95% eff, 25kHz. Mains powered, can power up to 50W halogen or incandescent lamps. Not approved, but good for components, experimenting **$10 ea. or 4 for $30.**

CCD CAMERA

SPECIAL Very small PCB CCD camera with auto iris lens, 0.1lux 320k pixels, IR responsive, has 6 IR LEDs on PCB, almost matchbox size! **$180**
We may be able to supply a used 12V green monitor and conversion kit for an extra **$35** See SC June 95

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PROJECTION LENS Brand new, precision angled projection lens. Overall size 210x136mm. High-impact Lexan housing with focal length adjustment. When disassembled yields three 4" diameter lenses convex-concave, convex-convex, concave. Very limited quantity. **$35**

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USSR LENS 58mm/f2 Pentax screw mount, used for cameras, has focus and iris adj **$60**

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IR LEDs 880nm 60º 30mW @ 100mA **10 for $9**

IR LEDs 940nm 12º 16mW @ 100mA **10 for $5**

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IR LASER DIODE 5mW/780nm **$16**

IR LASER DIODE 40mW/830nm **$60**

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ELECTROCARDIOGRAM EA July 95

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